DOCUMENT RESUME

ED 241 744 CE 038 533

AUTHOR Yuen, Chi-Yuen
TITLE An Analysis of Vocational Teachers' Understandings of and Attitudes toward Using Microcomputers in Vocational Education. Final Report. Vocational-Technical Education Research Report, Volume 22, Number 1.
INSTITUTION Pennsylvania State Univ., University Park. Dept. of Vocational Education.
SPONS AGENCY Pennsylvania State Dept. of Education, Harrisburg. Bureau of Vocational and Technical Education.
PUB DATE Jun 84
NOTE 126p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC06 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; *Computer Oriented Programs; *Microcomputers; Questionnaires; Secondary Education; State Surveys; *Teacher Attitudes; Trade and Industrial Education; *Vocational Education; *Vocational Education Teachers
IDENTIFIERS *Pennsylvania

ABSTRACT

To determine the knowledge and attitudes of vocational education teachers about microcomputers and about their use in vocational education, questionnaires were mailed to 273 vocational teachers from 11 randomly selected area vocational and technical schools throughout Pennsylvania. Although the level of understanding that the vocational teachers had about microcomputers was relatively low, the teachers were overwhelmingly in favor of the use of microcomputers in vocational education. The vocational teachers' understanding about microcomputers and their attitudes toward using them were positively correlated with educational level, microcomputer experience, microcomputer training, utilization of microcomputers, and the availability of microcomputers, whereas their attitudes toward and understanding of microcomputers showed negative relationships with age and service area. Based on these findings, recommendations were made calling for more workshops or inservice training programs for all teachers, especially for home economics and trade and industrial education teachers, and for the introduction of at least one course in computer literacy as a requirement for the certification of vocational teachers. (Appended to this report are the survey instrument, a summary of responses to each question on it, and correlation data for trade and industrial teachers.) (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED241744

THE
PENNSYLVANIA
STATE
UNIVERSITY
DEPARTMENT
OF
VOCATIONAL
EDUCATION

FINAL REPORT

AN ANALYSIS OF VOCATIONAL TEACHERS' UNDERSTANDINGS OF AND ATTITUDES TOWARD USING MICROCOMPUTERS IN VOCATIONAL EDUCATION

CHI-YIN YUEN, INVESTIGATOR
THOMAS E. LONG, MAJOR ADVISOR
DIVISION OF OCCUPATIONAL AND VOCATIONAL STUDIES

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

PROJECT NUMBER
83-4012

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

C. Yuen

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

THE PENNSYLVANIA STATE UNIVERSITY
UNIVERSITY PARK, PENNSYLVANIA

VOCATIONAL – TECHNICAL EDUCATION Research Report

CE 038 533

JUNE 1984
VOLUME 22, NUMBER 1

DISCLAIMER

This activity was supported in whole or in part by the United States Office of Education, Department of Health, Education and Welfare through the Pennsylvania Department of Education (PDE), Bureau of Vocational Education. However, the opinions expressed herein do not necessarily reflect the position or policy of the United States Office of Education, Pennsylvania Department of Education (PDE), or the Bureau of Vocational Education and no official endorsement should be inferred.

ABSTRACT

The purpose of this study was to determine how much knowledge vocational teachers have about microcomputers and to investigate the attitudes that vocational teachers hold about the use of microcomputers in vocational education. In addition, the study attempted to explore the relationships between vocational teachers' understandings of microcomputers and teachers' attitudes toward using microcomputers in vocational education and to examine some factors which may have influenced their understandings and attitudes.

All vocational teachers in area vocational-technical schools in the Commonwealth of Pennsylvania during school year 1983-1984 were considered as the target population. The final sample for this study consisted of 273 vocational teachers from eleven randomly selected area vocational-technical schools in the Eastern, Central, and Western regions of Pennsylvania.

The data were collected through a mailed questionnaire. The questionnaire included three major parts. The first part was designed to obtain selected vocational teachers' characteristics. The second part measured vocational teachers' understandings about microcomputers and the last part was a 25-item Likert attitude scale which was designed to measure vocational teachers' attitudes toward using microcomputers in vocational education.

A pilot study was conducted to evaluate and validate the instrument. The results of the pilot study indicated that the

coefficient alpha index of reliability was 0.938 and 0.963 for the understanding section and the attitude section, respectively.

Major findings of the study were:

1. The level of understanding vocational teachers had about microcomputers in the Commonwealth of Pennsylvania was low. However, vocational teachers overall were in favor of the use of microcomputers in vocational education.
2. A significant positive relationship was found between vocational teachers' understandings about microcomputers and their attitudes toward using microcomputers in vocational education.
3. Vocational teachers' understandings about microcomputers and their attitudes toward using microcomputers were positively correlated with educational level, microcomputer experience, microcomputer training, utilization of microcomputers, and the availability of microcomputers, but vocational teachers' understandings about microcomputers and their attitudes toward the use of microcomputers showed negative relationships with age and service area.
4. There were significant differences in teachers' understandings about microcomputers between/among various groups of teachers in terms of their educational level, service area, microcomputer experience, microcomputer training, utilization of microcomputers, and the availability

of microcomputers. In addition, it was found that there were significant differences in teachers' attitudes toward using microcomputers between/among various groups of teachers in terms of their age, service area, microcomputer experience, microcomputer training, utilization of microcomputers, and the availability of microcomputers.

TABLE OF CONTENTS

	Page
DISCLAIMER	ii
ABSTRACT	iii
LIST OF TABLES	viii
ACKNOWLEDGEMENTS	xi
Chapter	
I. INTRODUCTION	1
Need for the Study	3
Statement of the Problem	6
Significance of the Study	9
Definition of Terms	11
II. REVIEW OF LITERATURE	12
Introduction	12
Instructional Uses of Microcomputers	12
Computer-Assisted Instruction	13
Computer-Managed Instruction	21
Applications of Microcomputers in Vocational Fields	22
Computer Literacy	25
Attitudes Toward Microcomputers	29
III. PROCEDURES	33
Population and Sample	33
Research Instrument	34
Pilot Study	37
Reliability	37
Validity	40
Collection of Data	42
Methods	43
Management of Data	43
Analysis	44
IV. FINDINGS	48
Introduction	48
Question #1	52
Question #2	56
Hypothesis 1	56
Hypothesis 2	58
Hypothesis 3	58

TABLE OF CONTENTS (Continued)

Chapter		Page
	Question #3	59
	Hypothesis 4	59
	Hypothesis 5	73
	Hypothesis 6	76
	Hypothesis 7	76
	Hypothesis 8	79
	Hypothesis 9	81
	Summary	81
V.	SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	86
	Summary	86
	Statement of the Problem	86
	Procedures	87
	Findings	89
	Conclusions	92
	Recommendations	93
REFERENCES		96
APPENDIX A:	QUESTIONNAIRE	103
APPENDIX B:	SUMMARY OF RESPONSES TO EACH QUESTION IN PART A OF THE QUESTIONNAIRE	110
APPENDIX C:	CORRELATIONAL DATA FOR TRADE AND INDUSTRIAL TEACHERS	113

LIST OF TABLES

Table		Page
1.	Number of Vocational Teachers from Each School Participating in Study	35
2.	Summary of the Results of Likert Attitude Scale Analysis	39
3.	Estimated Number of Items Required to Achieve Certain Reliabilities	41
4.	Distribution of Item-Total and Adjusted Item-Total Correlation Coefficients in the Pilot Study Questionnaire	41
5.	Codings for the Variates	45
6.	Frequency Distributions of Selected Variates	50
7.	Number, Means and Standard Deviations for Vocational Teachers' Understandings and Attitudes Toward Using Microcomputers in Vocational Education	54
8.	Frequency Distributions of Understandings Scores	54
9.	Frequency Distributions of Attitude Scores	55
10.	Correlations Among Criterion Variables and Selected Variates for Question #2	57
11.	Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Age Level	60
12.	Summary of Analysis of Variance for the Variate of Age	60
13.	Follow-Up for All Possible Pairs by Vocational Teachers' Age Level on Their Scores of Attitudes Toward Using Microcomputers	62
14.	Number, Means, Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Sex	63
15.	Summary of Analysis of Variance for the Variate of Sex	63

LIST OF TABLES (Continued)

Table		Page
16.	Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Educational Level	64
17.	Summary of Analysis of Variance for the Variate of Educational Level	64
18.	Follow-Up for All Possible Pairs by Vocational Teachers' Educational Level on Their Scores of Understandings About Microcomputers	66
19.	Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Service Area	67
20.	Summary of Analysis of Variance for the Variate of Service Area	69
21.	Follow-Up Study for All Possible Pairs by Vocational Teachers' Service Areas on Their Scores of Understandings About Microcomputers	70
22.	Follow-Up Study for All Possible Pairs by Vocational Teachers' Service Areas on Their Scores of Attitudes Toward Using Microcomputers	72
23.	Summary of Analysis of Variance for the Variate of Teaching Experience	74
24.	Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by the Length of Teaching Experience	74
25.	Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by School Location	75
26.	Summary of Analysis of Variance for the Variate of School Location	75
27.	Summary of Analysis of Variance for the Variate of Microcomputer Experience	77

LIST OF TABLES (Continued)

Table		Page
28.	Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Microcomputer Experience	77
29.	Summary of Analysis of Variance for the Variate of Microcomputer Training	78
30.	Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Microcomputer Training	78
31.	Summary of Analysis of Variance for the Variate of Utilizations of Microcomputers	80
32.	Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Utilization of Microcomputers	80
33.	Summary of Analysis of Variance for the Variate of Availability of Microcomputers	82
34.	Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Availability of Microcomputers . . .	82

ACKNOWLEDGEMENTS

The author wishes to thank the following persons for their assistance in the distribution of questionnaires to their vocational teachers: Mr. Kenneth Baker, Mr. Robert Brown, Mr. Bob Fletcher, Dr. Norton Garfinkel, Mr. Henry Hoover, Mr. Earl Horst, Mrs. Edith Walker, Mr. Clair Kenny, Mrs. Juanita Moore, Mr. Kenneth Erisman, and Ms. Marilyn Zarzecki. Also, appreciation is extend to those vocational teachers who participated in the study.

Gratitude is extended to Mr. James Wise, Mr. Bill Wade, Mrs. Barbara Wade, Ms. Pam Blake, and Mr. Richard Walter for their assistance and coordination of the schools.

A special appreciation is extended to Dr. Thomas Long, Dr. Elizabeth Ray, Dr. Frederick Welch, and Dr. George Hudson for their interest, support and constructive advice throughout the study. Appreciation is also extended to Mr. John Brandt, State Supervisor for Trade and Industrial Education for his input and interest in the study.

CHAPTER I

INTRODUCTION

The microcomputer prevails today in business, industry, and science, and the use of microcomputers in vastly new applications is expected at tremendous rates through the 1990's and into the year 2000 (Uthe, 1982). During the past few years, microcomputers have had a dramatic impact within the business domain. It is estimated that almost 750,000 business workers are currently using microcomputers (Seaman, 1981). With the availability of inexpensive microcomputers, their use for instructional purposes has also increased dramatically in the public education domain. Today, two-thirds of the high schools and one-third of the elementary schools in the United States have at least one microcomputer for student use. By 1987, nearly all high schools in the United States will have microcomputers, with an average of 35 microcomputers per school (Bell, 1983a). A survey by the National Center for Educational Statistics reported that 96,000 microcomputers were available to elmentary and secondary school students in the United States in the Spring of 1982. Approximately 80 percent of the schools surveyed had microcomputers. The number of microcomputers available for instructional use in public schools tripled between fall 1980 and spring 1982 (Love, 1982). A report by Strategic Inc. of San Jose, California, predicted that the demand for microcomputers in schools will triple by 1985, to an installed base of more than 1.6 million. Another survey conducted by Future Computing,

Inc. in Dallas, Texas, projected that the market for educational software will increase by a factor of 14 by 1987--a compound annual growth rate of 71 percent (Bell, 1983b).

Given the fact that, the use of microcomputers in academic settings has expanded dramatically, educators around the world are rapidly working computer education into curricula (Spencer, 1974). Vocational educators have recently expressed great interest in microcomputer application for their programs. For instance, Jelden (1980) completed a four-year study of the application and feasibility of using microcomputer as an interactive tutorial instructional tool in self-contained vocational classrooms. Wilkins and Leising (1981) developed resources to permit agricultural education teachers to use microcomputer instruction in subjects as different as animal science, agricultural economics, and horticulture. Randolph and Bringman (1971) suggested ways in which vocational teachers could make full use of the computer as an educational tool suited to the industrial education curriculum. Cheng (1982) introduced computer technology and microcomputer oriented activities in his graphic arts shop. Westberg (1980) developed a hotel/motel program which used microcomputers to prepare students for front-desk jobs. Asplen (1980) produced training materials for installation of minicomputers and microcomputers in residental and small business buildings. Matthews (1980) described the wide range of applications of microcomputers to vocational education, including text processing and statistical analysis

previously unavailable to many vocational students. These are but a few of the reported applications for microcomputer technology in vocational education. However, it appears that soon microcomputers will in some way be affecting most vocational teachers and educators. Vocational educators are only now recognizing and attempting to meet this challenge.

Need for the Study

Microcomputers are touching all aspects of our lives. More and more people agree that everyone should have at least a basic understanding of computers to live effectively in our society. Since an understanding of computers is becoming so essential, it is imperative that the educational system respond to this need. Joseph Lipson in a 1970 report for the National Science Foundation (NSF) said:

> Failure of the Federal Government to move swiftly to facilitate educational uses of the new technologies will endanger the economic and, eventually, the military security of the country. If our democratic institutions are to remain stable, we must welcome, rather than fear or ignore, the imperatives of technological change. It is unlikely that we can do this without firmly weaving advanced informational technologies into the fabric of our education system. (Lidtke, 1981, P. 26-28)

Recently, a Department of Education Survey of microcomputer use in Pennsylvania public schools reported that about 7,500 microcomputers were used in state school districts, intermediate units

and vocational-technical schools in the fall 1982. According to the survey, a 53 percent increase in microcomputer acquisition by schools, totaling almost 11,500 microcomputers, is projected for the 1983-1984 school year. Teachers use microcomputers primarily for teaching their subjects, for computer programming, computer literacy, classroom management and testing, while administrators tend to use them for attendance records, scheduling, payroll, budgeting, maintenance, school bus schedules and inventories. The survey showed that 305 school districts are providing computer literacy courses for students, and that computers are most often used in math, science, business education, computer literacy, and computer programming classes. In addition, the survey indicated that training for teachers in microcomputer use was urgently needed. Less than 4 percent of the state's more than 100,000 school teachers are adequately trained in microcomputer use, and almost 79 percent of teachers covered by the survey said they had no computer literacy or proficiency. Such suggests that the need for training in at least the basic elements of computer literacy is urgent (Pennsylvania Department of Education, 1983).

As microcomputers become inexpensive, accessible, and durable, they permeate our schools and impact on our education. Evidence regarding the achievement and attitude of students indicates that, if microcomputers are used under the control of teachers as an integral part of instruction, they can be highly successful and produce a

better quality of education. A study conducted by Kulik and others at the University of Michigan has shown that students in secondary schools who have the chance to supplement their learning through microcomputers learn more, do better on tests, and get better grades than students who do not have that opportunity (Bell, 1983a). In addition, Kamla pointed out that microcomputers create an environment for learning and bring to each student the advantages of immediate feedback and reinforcement, self-paced instruction, and the potential for strengthening the skills of reading and mathematics. With the use of microcomputers, students' motivation and self-esteem are also boosted (Emmett, 1983). Microcomputers have proven themselves to be effective teaching tools and now these tools are within reach for all levels of education. One problem today is to introduce and integrate microcomputers into the instructional setting in a way that will allow them to operate effectively and yield the benefits which have been shown to be possible. Such relates to teachers' understandings of microcomputers, their attitudes toward and acceptance of microcomputers, their capability of using microcomputers in learning and instruction, and the availability of curricula using computerized instructional programs (Hallworth & Brebner, 1980).

Passmore (1983) indicated that the microcomputer revolution could affect the efficiency and productivity of vocational education. In order to capture the improvements in efficiency and productivity, vocational teachers and educators must be prepared through pre-service

and in-service training activities to learn what the microcomputer is and what it does. However, before providing in-service workshops or training sessions on the use of microcomputers for vocational teachers, the teachers' understandings and attitudes toward using microcomputers should be taken into consideration. The attitude of vocational teachers toward microcomputers and their uses in vocational education will greatly influence the vocational teachers' commitment to and the subsequent success of vocational education programs. Therefore, it is very important to understand teachers' knowledge and attitudes so that effective strategies and activities can be developed to meet their needs, to help them to break down barriers to using the microcomputer, and to become successful in their use of the microcomputer in vocational education. In addition, since many people believe that microcomputers will improve education, it is worthwhile to determine if corresponding attitudes exist on the part of vocational teachers. An assessment of vocational teachers' attitudes in the Commonwealth of Pennsylvania should precede any full-scale statewide commitment to microcomputers in vocational education.

Statement of the Problem

The purpose of this study was to determine how much knowledge vocational teachers have about microcomputers and to investigate the attitudes that vocational teachers have about the use of microcomputers in vocational education. In addition, the study

attempted to explore the relationships between vocational teachers' understandings of microcomputers and teachers' attitudes toward using microcomputers in vocational education and to examine some factors which may have influenced their understandings and attitudes. In order to achieve this purpose, the study sought to answer the following questions and test the following hypotheses:

Question #1

> What are the understandings and attitudes of teachers toward using microcomputers in vocational education?

This question was presented as a research question only and was not stated in hypothetical terms since it was not subjected to statistical analysis.

Question #2

> What relationships exist among teachers' understandings and their attitudes toward using microcomputers in vocational education and selected variates relating to teachers' charactertics?

H.1: There is no relationship between teachers' understandings about microcomputers and teachers' attitudes toward using microcomputers in vocational education.

H.2: There is no relationship between teachers' understandings about microcomputers and selected variates (age, sex, educational level, service area, teaching experience, school location, microcomputer experience, microcomputer training, utilization of microcomputers, and availability of microcomputers) relating to teachers' characteristics.

H.3: There is no relationship between teachers' attitudes toward using microcomputers in vocational education and selected variates relating to teachers' characteristics.

Question #3

Are there differences in teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers between/among various groups of teachers in terms of their characteristics?

H.4: There is no difference in teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers by age, sex, educational level, service area, and the length of teaching experience.

H.5: There is no difference in teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers by the location of school.

H.6: There is no difference between teachers who have had experience in working with microcomputers and those who have not in

their understandings about microcomputers or their attitudes toward using microcomputers.

H.7: There is no difference between teachers who have had special training, workshops, pre- or in-service training, and college courses in using microcomputers and those who have not in their understandings about microcomputers or their attitudes toward using microcomputers.

H.8: There is no difference between teachers who have used microcomputers in vocational education programs and those who have not in their understandings about microcomputers or their attitudes toward using microcomputers.

H.9: There is no difference in teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers by the availability of microcomputers at home or at school.

Significance of the Study

The increased availability of microcomputers in all aspects of education and work heralds a new era for vocational training. Not only will additional programs be required for the new jobs created by microcomputer technology, but many existing programs will also have to be updated to reflect computer-related skills that will be used in a variety of non-computer specific jobs. Administrators and vocational teachers must plan knowledgeably for vocational programs that will prepare students for new and emerging computer and computer-related careers. All educators must also become aware of computerized

resources that can alter and improve instructional methods at all levels of education (Roblyer, 1980).

Students in vocational education of the 80's will be involved in many technological changes brought about by the microcomputer. The microcomputer will be able to reinforce, teach, and entertain students, while presencing content and concepts previously taught by traditional methods. Thus, the microcomputer will alter the way subjects are taught and students learn in the vocational schools of the future (Rice & Mosow, 1981).

Planning for the implmentation of microcomputers in vocational education requires a carefully thought out series of steps, ranging from establishing the objectives in identifying the hardware and software to meet those objectives, to choosing the specific microcomputer. But even before initiating those steps, the most important one is to determine what teachers think about microcomputers. The investigation of teachers' understandings and attitudes will not only involve potential users in the early planning stages of microcomputer implementation, but will also provide valuable information about such things as in-service training needs and strategies (Poirot & Heidt, 1982).

The findings of this study will provide vocational teacher educators, administrators, and other educators with evidence of the degree of understanding of microcomputers by vocational teachers and the level of acceptance or resistance toward using microcomputers in vocational education. Based on the findings of this study, clearer

direction for vocational administrators and educators who plan for the implementation of microcomputers in vocational education will emerge. In addition, professional development and instructional activities to help reduce the barriers for vocational teachers in the use of microcomputers in vocational education can be structured. Most important, it will provide direction for curriculum development, instructional methods and strategies, supervision and management, and teacher training in vocational education.

Definition of Terms

The following definitions are provided for terms used throughout this study.

Attitude toward using microcomputers. The perceptions, beliefs, and the level of acceptance or resistance toward using microcomputers in vocational education.

Microcomputer. A complete computer system whose central processing unit is a microprocessor.

Understanding of microcomputers. This term is used to specify how much a person understands about what a microcomputer is, what it does, and how to use it in vocational education.

Vocational education. Vocational education means organized educational programs which are directly related to the preparation of individuals for paid or unpaid employment, or for additional preparation for a career requiring other than a baccalaureate or advanced degree (Federal Register, 1977, p. 53865).

CHAPTER II

REVIEW OF LITERATURE

Introduction

The purpose of this chapter is to review the literature related to this study. The review is presented in the following sections:

1. Instructional uses of microcomputers
2. Applications of microcomputers in vocational fields
3. Computer literacy
4. Attitudes toward microcomputers

Instructional Uses of Microcomputers

Microcomputers are now playing an active role in the educational process. In the early 1960's, experiments on the use of computers in education attested to their value as educational tools. However, the use of the computer for instructional purposes was extremely limited since in the 1960's computers were expensive, difficult to use, and vaguely threatening to many educators. Today, the presence of microcomputers in schools is causing an impressive rebirth of instructional use of the computer. Its low initial cost, portability, and relative ease of use make it ideal for many educational situations. Chambers and Bork (1980) state that projections for 1980-85 indicate that computer-assisted learning will be used by more school districts than any other type of computer application. Usage

is anticipated to rise from 54 percent of the districts to 74 percent. Microcomputers are expected to play an increasingly significant role in the use of computer-assisted learning in the school district (p. 39-40).

A search of the literature reveals that most educators would agree that the instructional use of microcomputers can generally be divided into two broad categories: computer-assisted instruction (CAI) and computer-managed instruction (CMI) (Forman, 1983, Miller, 1980a, Splittgerber, 1979).

Computer-Assisted Instruction (CAI)

Computer-assisted instruction is often used interchangeably with the terms "computer-based instruction," "computer-aided instruction," and "computer-assisted learning." It covers a large number of applications of computers in education. CAI rises from the programmed instruction concepts introduced by Skinner (1954) and Crowder (1960) and the emerging technology of the computer in the mid 1960's. CAI is a teaching process directly involving the computer in the presentation of instructional materials in an interactive mode to provide and control the individualized learning environment for each individualized student (Splittgerber, 1979, p. 20).

There are several forms of CAI: the most common is drill and practice where previously learned information is rehearsed or practiced to obtain mastery. Work in CAI continues to focus on

decision models and strategies which use the learner's past performance to decide what new materials to present to optimize learning through drill and practice (VonFeldt, 1977). Another common form of CAI is the tutorial, in which the computer guides the student through a program of learning, setting the pace to suit the student. Simulation and gaming are also CAI uses through which students can experience life-like situations and learn the consequences of their own decision making and problem solving behavior (Spitzer, 1980). Other forms of CAI include information retrieval and inquiry/dialogue (Milner, 1980a).

The recent evalutation of CAI done by the U. S. Office of Technology Assessment (OTA) reported four factors related to the increased interest in CAI and other forms of interactive electronic learning in schools. First, declining costs are making microcomputers more affordable to schools. Second, the escalating costs of traditional labor-intensive classroom teaching makes this inexpensive technology even more attractive as a way of giving students individualized instruction. Third, an improved understanding of how to create instructional packages is encouraging teachers to explore the new educational technology. And finally, the development of alternative delivery mechanisms that link the computer with other technologies such as the video disk and interactive cable television is offering schools a wide array of new instructional aids (Office of Technology Assessment, 1982).

Computer-assisted instruction appears to be a commonly utilized technology for industrial training. Kearsley, Hillesohn, and Seidel (1981) surveyed the use of microcomputers in the training programs of selected Fortune 500 companies. They found that 50 percent of the organizations responding were using computers for training and that 71 percent of those usages included the use of microcomputers. In addition, the Office of Techonlogy Assessment (1982) reported that technical personnel such as entry-level engineers, field service representatives for computerized equipment, development programmers, and applications programmers were frequently trained using CAI packages.

Research in both the public and private sectors demonstrates that properly prepared CAI can increase student competencies and decrease total instruction time. Large industry-based training programs, such as that conducted by United Airlines to prepare personnel to work on new airplanes, demonstrated the cost effectiveness of CAI (Nasman, 1982). Vocational education similarly benefits from CAI. For example, the University of Calgary developed programs on the COMPUCOLOR to teach the operation of an internal combustion engine, and the use of a micrometer (Hallworth & Brebner, 1980).

In reviewing a number of studies evaluating CAI and other educational technology, the Office of Technology Assessment (1982) concluded that "there is a substantial amount of agreement that, for many educational applications, information technology can be an

effective and economical tool for instruction" (p. 63). This conclusion was based on a number of observations including the fact that "research exists, some of it dating back years, to suggest that students do learn as well or better from educational technology than from conventional means. Little evidence exists to the contrary" (Office of Technology Assessment, 1982, p. 63).

Examination of the literature pertaining to the benefits of CAI documents a number of factors. The computer has the capability to individualize the instructional process; to simulate experiences not possible without computers; to investigate complex problems using instruments and methodology which would be excessively costly or not possible at all without the computer; to keep students informed of their progress through immediate feedback and achievement summaries; to provide immediate and systematic reinforcement; to provide instruction that has been systematically prepared, sequenced, tested and revised; and to allow students to review previous instructions, request special help or provide special enrichment activities (Bork & Franklin, 1979; Chambers & Bork, 1980; Chambers & Sprecher, 1980; Forman, 1983; Holmes, 1982; Kerlinger, 1967).

In addition, researchers argue that because the computer involves the individual actively in the instructional process, learning is facilitated and CAI frees the teacher from the repetitive aspects of teaching to devote more time to the personal, human considerations of their students (Forman, 1983).

The question concerning the relative effectiveness of CAI in terms of student performance is still being debated. Most experiments have indicated that CAI is at least as effective as traditional instruction, and a recent study gives strong evidence that, in some subject areas at least, a curriculum supplemented by CAI does lead to improved student achievement (Burns & Bozeman, 1981). Other studies also indicated that with CAI the rate of learning can be improved (Holmes, 1982; Magison, 1978).

Kulik, Bangert, and Williams (1983) examined over 300 CAI research studies which had been administered around the U. S. since the middle 1970's. Some 250 of the studies were eliminated because of methodological flaws or other problems, but the remaining 51 research studies of computer-assisted instruction shared a remarkable and dramatic conclusion. They found that students who received CAI scored higher on objective tests than students who received conventional instruction only. Also, they found that CAI improved students' retention of information, improved students attitudes toward computers and toward their course, and reduced the amount of time needed for learning.

Aiken and Braun (1980) suggest that attitudinal studies of CAI effectiveness may be more productive for measuring effect on overall learning than gains in performance. In comparison studies of CAI and control classes, Cavin, Cavin and Lagowski (1981) found that students' attitudes toward the content studied improved when using CAI.

Students who were randomly assigned to CAI classes reported more positive attitudes toward content than students in the non-CAI classes.

In reviewing the literature, Forman (1983) summarized a number of research results regarding the effectiveness of CAI in the learning process:

> 1. The use of CAI either improved learning or showed no difference when compared to traditional classroom approaches.
> 2. The effect on achievement occurred regardless of the type of CAI used, the type of computer system, the age range of the students, or the type of instrument used to make the measurements.
> 3. When CAI and traditional instruction are compared, equal or better achievement using CAI is obtained in less time.
> 4. Students have a positive attitude towards CAI, frequently accompanied by increased motivation, attention span, and attendance in courses. (p. 129)

In addition to the above benefits, Forman (1983) summarized from the literature a number of other interesting and significant factors relating to the effectiveness of CAI:

> 1. Tutorial and drill modes seem to be more effective for low-ability students than for middle or high-ability students;
> 2. Many reluctant learners become active and interested learners when involved in computer supported programs;
> 3. The bulk of the studies showing CAI to be effective have concerned the use of adjunct CAI in which the classroom teacher was readily available;
> 4. Poor attitudes on the part of instructors and administrators have resulted in overt sabotage to the computer learning process;

5. Foreign languages and science are two areas in which CAI programs consistently have been shown to be effective;
6. CAI is helpful to students reviewing materials with which they had prior familiarity; and
7. Retention rates may be lower than for traditional means. (p. 129)

Even though the type of CAI mode used (tutorials, drill and practice, games and simulations) has varied and the learners concerned have ranged from elementary school children through adults in training programs, the studies have shown consistent results: computer assisted instruction works. Bell (1983b) indicated that CAI gives students the opportunity to practice what they have learned and to get better at it. Through the detailed and highly individualized feedback provided by the computer, CAI helps students acquire habits of precision in their work. In addition, CAI has positive effects on the students' attitude toward the computer. Moreover, the rapid growth of microcomputers in schools indicates that they are the wave of the future. CAI can be very effective especially if the software designed for microcomputers takes advantage of what has been learned from a decade of research with terminals.

Despite the advantages of CAI, Osborne (1979) stated that "CAI has been around for a long time, yet I doubt if there is any place where the computer has offered so much potential and delivered so little product" (p. 91). Melmed (1982) listed the following factors which he felt would delay the full use of CAI by as much as 20 years:

1. Budgets that do not allow sufficient money to purchase enough microcomputers.

2. Poor courseware availability.
3. Lack of current investment in developing new approaches to student uses of computers. (p. 308)

Furthermore, Chambers and Bork (1980) found that the impediments to the implementation of CAI were financial as well as due to a lack of knowledge about CAI and computers in general, the attitudes of faculty, and the need for more and better CAI instruction modules. In addition, Forman (1983) indicated that the lack of information about the effectiveness of CAI, the tremendous financial commitment to a technological innovation that is new, untried and uncomfortably similar to educational television, depersonalization of the educational process, and lack of support from teachers and teachers' organizations were also the reasons why it was advisable to adopt a wait-and-see attitude.

Chambers and Bork (1980) indicated that the disadvantages of using CAI in the learning process can be summarized into three main categories: (a) the need for teachers to move from accepted and working methods to a new and relatively untried method in which most individuals have little expertise and which arouses considerable fear and antipathy due to its technological base; (b) the primitive state of the art, in which a diversity of computing hardware and CAI languages compete with little apparent coordination from professionals in the educational world; in which the majority of available CAI course materials are poorly constructed, largely undocumented, and able to run on only select computers for which they were written; and

in which there are relatively few "experts" to whom CAI users can turn for assistance; and (c) the cost of hardware, courseware, and individuals to help implement the process (p. 3-4).

Computer-Managed Instruction (CMI)

Splittgerber (1979) defined computer-managed instruction as an instructional management system utilizing the computer to direct the entire instructional process. CMI has some or all of the following characteristics: organizing curricula and student data, monitoring student progress, diagnosing and prescribing, evaluating learning outcomes, and providing planning information for teachers (p. 20).

Computer-managed instruction refers to the use of computers to provide support services for teachers and administrators. CMI uses the computer to keep track of attendance, to schedule classes, to select instructional topics and materials, to schedule presentations and testing, to administer tests, to tabulate grades, to maintain inventories of supplies, and to maintain analytical reports, diagnose learning problems and prescribe instructional programs.

Microcomputers make it possible to monitor students' progress through the objectives of a course and to flag potential problems or even identify appropriate instructional units based on students' performance (Podemski, 1981). McIsaac (1980) described a microcomputer CMI system with which all elementary school teachers could plan for and manage reading and math instruction for all their

students. Student testing and assessment are specific CMI applications. Schneider (1980) developed a procedure for assessing student levels in a secondary mathematic curriculum. Eisele (1979) discussed the testing and test scoring uses of the computer. Milner (1980a) described record keeping, scheduling of student activities, construction of lists and rosters, and time and resource management as additional CMI applications.

During the past decade, a few articles reported the use of CMI in vocational education. Rannells (1973) described the use of a computer in evaluating student achievement in a horticultural program. Dupuis and Bell (1974) described a modular approach which used a CMI system to keep records of student achievement. Danford (1974) developed a CMI system which prescribed modules, scheduled students, and recorded their achievement of job tasks in a vocational education program.

Based on the literature reviewed, it is felt that CMI can help vocational teachers plan for and monitor students learning experiences. Through CMI programs vocational teachers can plan curricular/instructional options for different instructional objectives on the basis of individual student abilities and performance.

Applications of Microcomputers in Vocational Fields

Although the microcomputer industry is not yet a decade old, it has already made a major impact on the home, agriculture, business,

and industry. Microcomputers are used to assist farmers in herd improvement, identifying productive animals, and planning best-feed diets. Microcomputers also enable farmers to perform crop rotation analyses (Uthe, 1982). In addition, farmers use microcomputers for pest management. They use microcomputers to evaluate the rate of spread of insect populations and to prescribe when and how much insecticides to use to minimize ecological damage and cost (Molnar, 1980).

Computer-aided management tools permit planners to compare manufacturing costs for dozens of products in numerous countries over a several year period and to simulate the consequences of various corporate actions. The use of computer-aided design (CAD) has been found, on the average, to produce a gain in productivity by a factor of six. Engineers use computer graphics to simulate the structural characteristics of a car and simulate the assembly of components and road tests before it is built (Molnar, 1980). Buildings, shoes, machine tools, airplane parts, bridges, textiles, clothing, needlepoint--all can be designed and modified using the computer.

Microcomputers are changing the business office. Microcomputers are now being used for word processing, accounting, filing, billing, invoicing, payroll, inventory control, general ledger, sales analysis, cost analysis, budget projections, and market analyses and projection. Stewart (1979) predicted that microcomputers would cause an organization revolution in the office of the future much as the assembly line did for the factory worker.

Microcomputers enable homemakers to perform nutritional analysis, to estimate food expenditures, to select clothing and textiles based on individual characteristics, to perform financial analysis, and to design housing, household equipment, and interiors. In addition, microcomputers enable chefs to use computerized inventory files and nurses to file patients' records electronically.

The literature shows that microcomputer capabilities touch all vocational fields. Nasman (1982) indicated that as business and industry develop more applications for microcomputers, vocational educators have to monitor the ways these applications may affect the basic content of instructional programs. As microcomputers change the tools used in business and industry, they also change the content and level of education required to do or hold a job. Vocational educators must increase their contacts with business and industry to maintain the relevance of educational programs. And as microcomputers change the very nature of jobs, vocational educators may be faced with an increasing number of workers who need retraining or upgrading to remain employed. This will present an additional challenge for vocational educators (p. 38).

Uthe (1982) stated that vocational teachers and administrators must become computer literate and be able to use them. Since all careers will involve the use of microcomputers, curricula in all vocational programs must incorporate microcomputers as a job tool and an instructional aid. The acquisition of microcomputers is imperative for vocational schools and technical institutions.

Computer Literacy

The term computer literacy is coming into widespread use without a clear, generally agreed upon definition. Although there is no consensus on what constitutes computer literacy, several useful definitions have been developed. Watt (1980) described computer literacy as that collection of skills, knowledge, understandings, values and relationships that allows a person to function comfortably as a productive citizen in a computer-oriented society.

Elliott and Peele (1975) defined computer literacy as (a) knowledge about computers, (b) knowledge of applications, (c) experience in usage, (d) use in the learning process, (e) skills in programming, and (f) issues in society. Coburn, Kelman, Roberts, Synder, Watt, and Weiner (1982) defined computer literacy as (a) the ability to program computers, (b) the ability to use pre-programmed applications of the computers, (c) the understanding of the role of computers in society, and (d) the ability to use computers to solve problems.

Eisele (1980) identified five areas which contribute to computer literacy. These five areas are: (a) computing skills for real-life problem solving, (b) computing skills for vocational and home use, (c) ethical attitudes toward producing computer services, (d) ethical attitudes toward consumption of computer services, and (e) a positive attitude toward the role of the computer in society.

Brumbaugh (1980) suggested that to be computer literate a person must be able to define, demonstrate, and discuss (a) how computers are used, (b) how computers do their work, (c) how to use a computer, and (d) how computers affect our society (p. 49).

The Human Resources Research Organization analyzed twenty-four college and university programs designed to increase the level of computer literacy among students and faculty. They defined computer literacy as what a person needs to know and do with computers in order to function competently in our society. They found that programs stress (a) skill in writing algorithms and microcomputer programs, (b) knowledge of computer applications, and (c) understanding of computers and their impact on society (Hunter, 1978).

Becker (1982) defined computer literacy for teachers as "familiarity with the variety of instructor-related tasks that microcomputers can be expected to have now or in the future; and experience in using microcomputers for text preparation and editing, test scoring, and packaged instructional programs. For many teachers, computer literacy should also include acquiring the ability to write BASIC language programs on existing microcomputers and to teaching programming" (p. 18).

Nasman (1982) indicated that microcomputers can be used to provide computer literacy for all vocational students and teachers. Since the changes in career and work patterns resulting from microcomputers are going to have profound impact upon vocational

education, the majority of occupations will in some way be affected by microcomputers in the next few years. Therefore, the majority of vocational teachers and their students must become, to some degree, computer literate.

In a recent national survey of teachers' attitudes toward and knowledge of computers, the results indicated that only one-fifth of teachers had received some computer training from a college or the local school system. In general, teachers reported that they were not well informed about computer knowledge (National Education Association, 1983).

Milner (1980b) reported that teachers knew very little about the potential for computer application in the classroom because they had no training in their use. Chambers and Bork (1980) found that teachers' lack of knowledge about CAI and computers was considered to be a major impediment to the implementation of CAI in the schools. That issue was second only to funding. Similarly, Hallworth and Brebner (1980) stated that CAI will not succeed in any environment where it does not have the full understanding and backing of teachers (p. 216). Teachers need information and knowledge and CAI needs teachers in order to be successful. Aiken and Braun (1980) stated that unless teachers acquire some basics of computer literacy, efforts to incorporate computer education into the curriculum will be wasted.

The literature tends to be a bit repetitive in that all of the researchers see a need for teachers to become computer literate. They

differ, however, in the degree of instruction needed for teachers to implement microcomputers successfully into the instructional process. Milner (1980b) expresses the concern that educational opportunities are being missed because most teachers do not know how to use computers nor can they teach their students about computer impact on society. Similarly, Bass, Brown, and Nold (1975) feel that teachers do not truly realize the potential of the microcomputer as a teaching resource or teacher's aide.

In response to the lack of computer literacy in teachers, Henderson (1978) recommended that all teachers should complete a minimum of two courses in computer science as a general requirement for certification. In addition, he suggested that all elementary teachers should complete one additional course covering the use of CAI materials for the elementary student, and secondary teachers should complete two additional courses to cover the use of computer-oriented materials and CAI materials for the secondary student and the development of computer related materials.

In order to maximize the success of computers in education at all levels of the educational spectrum and reach the objective of computer literacy for all, teachers need to understand that computers can help in the instructional process; they need to acquire appropriate computer skills; they need to have access to computer facilities; and they need to be aware of the strengths and weaknesses of computers in education (Stevens, 1980).

However, a vital prerequisite to the application of microcomputers in education is that of computer literacy. It is hard to imagine students becoming computer literate without computer literate teachers. Watt (1980) indicated that developing a computer literate school staff is a major aspect of education for computer literacy. Universal computer literacy is a basic skill of the 1980's and deserves a major role in the school curriculum. To educate students for computer literacy, schools must develop leadership, curricula, and computer-literate teaching staffs, while acquiring the necessary hardware and software.

Attitudes Toward Microcomputers

Microcomputers will not be used productively in education unless teachers have positive attitudes toward them and believe microcomputers to be viable instructional tools. Quite often teachers are wary of microcomputers because they feel threatened. Reluctance to use microcomputers may be based on the fear of losing security or classroom authority, or on a lack of computer skills and information (Beck, 1979).

Not much research has been done in the area of teachers' attitudes toward microcomputers. Although the literature is scarce, some little evidence is available that attitude toward and understanding of microcomputers contributes to successful implementation and use of these tools in education. Ahl (1976)

surveyed the public's attitudes toward computers in society. He found that most people were remarkably optimistic about the benefits the computer could bring to society. Young people tended to be less optimistic and felt more threatened by the computer than did adults. However, two-thirds of the respondents had a fair understanding of both the role and function of the computer although there were a few popular misconceptions.

Robardely (1971), in a study of Michigan teachers' attitudes toward computer-assisted instruction, found a positive relationship between teachers' level of knowledge and their attitudes. In a study of student attitudes toward computer-assisted instruction in Nebraska public high schools, Beck (1979) found that teacher attitudes toward computers was an important dimension to consider. The composite of teacher attitudes toward utilizing computers in the classroom was directly related to and contributed to the attitudes of students.

In a survey of educator's attitudes toward computers, Lichtman (1979) found that the educators seemed less enthusiastic about the computer's role in society than did the general public. Those in administration were generally far more positive in their attitudes than were other educators.

Taylor and Parrish (1978) investigated attitude toward computers in music education through a national survey of public school districts and college music departments. Results indicated that attitudes toward the computer were positive, although a large number

of respondents had little understanding of the computer and its uses in music education.

Stevens (1980) conducted a survey to assess computer knowledge and attitudes of Nebraska college professors. Results indicated that computer literacy instruction was deemed necessary; but the respondents felt unqualified to teach about microcomputers. Findings also reflected mixed feelings regarding computer-assisted instruction and computer-managed instruction.

A national survey of elementary and secondary teachers' attitudes toward and knowledge of computers by the National Education Association (1983) found that region, community type, school level, and sex showed statistically significant differences between teachers who use computers and teachers who do not. But there were no statistically significant differences in teachers' educational level and age between users and nonusers. In addition, it was found that users more than nonusers viewed the computer movement as being very likely to bring about change in education through the 1980's and to have positive effects on teaching.

Pickard (1983) conducted a study on attitudes of South Dakota Home Economics teachers toward the use of microcomputers. She found that there was a significant difference in attitude when educational background and availability of computers were considered. There was also a significant difference found when educational background was considered with the length of time computers had been in teachers'

schools. However, her study did not confirm that new teachers were more oriented to classroom computer use than their more experienced colleagues. Also, teachers holding higher degrees and teachers from larger schools did not have an attitude advantage.

Floyd (1983) found that although the level of knowledge about microcomputers among teachers in rural, central Pennsylvania was low, the attitude toward the instructional use of microcomputers by most teachers in rural Pennsylvania was positive. There was a significant difference between the knowledge scores of teachers of secondary technical and non-technical subject areas. Technical teachers displayed a higher level of knowledge and were more willing to use microcomputers. However, the two groups did not show a significant difference in attitude score.

Based on the literature reviewed, few studies specifically identify how understandings and attitudes toward using microcomputers will affect vocational teachers' use of microcomputers. Also, the findings of the previous studies provide little knowledge for vocational administrators and educators to use in their planning for implementation of microcomputers in vocational education.

CHAPTER III

PROCEDURES

The purpose of this study was to determine how much knowledge vocational teachers have about microcomputers and to investigate the attitudes that vocational teachers hold about the use of microcomputers in vocational education. In addition, the study attempted to explore the relationships between vocational teachers' understandings of microcomputers and teachers' attitudes toward using microcomputers in vocational education and to examine some factors which may have influenced their understandings and attitudes. The following sections outline the procedures for this study:

1. Population and Sample
2. Research Instrument
3. Pilot Study
4. Collection of Data
5. Methods

Population and Sample

The population for this study consisted of all vocational teachers in area vocational-technical schools in the Commonwealth of Pennsylvania during the school year 1983-1984. A vocational teacher is an individual employed in an area vocational-technical school who teaches a course in a program certified as being vocational in nature by the Pennsylvania Department of Education.

According to their geographic characteristics, eleven area vocational-technical schools (AVTSs) were randomly selected from the Eastern, Central, and Western regions. These eleven area vocational-technical schools were Bethlehem AVTS, Bucks County AVTS, North Montco AVTS, South Lackawanna County AVTS, Cumberland-Perry AVTS, Franklin County AVTS, Lebanon County AVTS, Harrisburg-Steelton-Highspire AVTS, Altoona AVTS, Forbes Road East AVTS, and Mercer County AVTS. All vocational teachers from these eleven randomly selected AVTSs were the sample of this study.

A total of 397 questionnaires were sent to vocational teachers in the eleven sample schools. As a result, 281 subjects returned the questionnaire by February 10, 1984. Of these, 8 subjects did not complete the questionnaire. Therefore, useful observations were reduced to 273, and a 68.8 percent rate of usable returns was accounted for. A breakdown of participants in the study is presented in Table 1.

Research Instrument

In order to answer the research questions, a questionnaire was developed to gather data on the level of knowledge about microcomputers and their attitudes toward using microcomputers in vocational education. The questionnaire consisted of three major parts. Part A consisted of 16 items to collect background information such as age, sex, educational level, service area, years of teaching

Table 1

Number of Vocational Teachers from Each School Participating in Study

Region	School	Number of Participants
Eastern	Bethlehem AVTS	36
	Bucks County AVTS	16
	North Montco AVTS	20
	South Lackawanna County AVTS	12
Central	Cumberland-Perry AVTS	17
	Franklin County AVTS	33
	Lebanon County AVTS	29
	Harrisburg-Steelton-Highspire AVTS	13
Western	Altoona AVTS	38
	Forbes Road East AVTS	32
	Mercer County AVTS	27
Total	11	273

experience, location of school, experience in working with microcomputers, training in using microcomputers, utilization of microcomputers in vocational education programs, and the availability of microcomputers. Part B consisted of 18 items which were designed to measure vocational teachers' understandings about microcomputers in vocational education. The vocational teachers answered each question by "Yes" or "No," representing two or one point(s) respectively. The total score for this part was the accumulated score of all 18 items. Therefore, the higher the score, the higher the level of understanding about microcomputers in vocational education. Part C consisted of 25 Likert type attitude items which were designed to measure vocational teachers' attitudes toward using microcomputers in vocational education. Each item in this part allowed for a five option response. The vocational teachers rated each question from "Strongly agree" to "Strongly disagree," ranging from five to one on the scale with the exception of some items which had to reverse the score from one to five because those statements were negative. The total score for this part was the accumulated score of all 25 items. The higher the score, the more positive the attitude about using microcomputers in vocational education.

Items on the questionnaire were based on a review of literature. Several items from the previous research cited were found useful in this study (Bouyer, 1982; Floyd, 1983). Bouyer's study provided a total of six attitude items. Floyd's study provided five

understanding items and twelve attitude items. These items were deemed appropriate once minor modifications were made. Additional items were developed by the researcher to meet specific objectives for this study.

In order to protect the human subjects participating in this study, the questionnaire was submitted to and approved by the Behavioral and Social Science Review Committee on Human Subjects at The Pennsylvania State University prior to actual use.

Pilot Study

Before the questionnaire was applied, a pilot study was conducted to evaluate and validate the questionnaire. A 66-item questionnaire with 22 items in the understanding section and 44 items in the attitude section was initially developed to measure vocational teachers' understanding and attitude toward using microcomputers in vocational education. The questionnaire was presented to 21 graduate students who were majoring in either agricultural education, home economics education, or vocational-industrial education at The Pennsylvania State University, as well as to 15 vocational teachers who taught in Centre County AVTS and Seneca Highlands AVTS during the Fall Term, 1983. Totally, 36 persons participated in this pilot study.

Reliability

In order to perform the item analysis and determine the reliability of the questionnaire, the LIKRT (Likert Attitude Scale

Analysis, Kohr, 1974), which was available at the Computation Center of The Pennsylvania State University, was applied to collected data. As a result, the Likert Attitude Scale Analysis indicated that the coefficient alpha index of reliability was 0.938 and 0.963 for the understanding and the attitude sections respectively. Summary information from the Likert Attitude Scale Analysis is shown in Table 2.

By using the Spearman-Brown Formula (Lemke and Wiersma, 1976), the estimated number of items needed to achieve certain reliability was also computed. Table 3 shows the estimated number of items required to achieve certain reliabilities. Based on these estimates, if a reliability of 0.90 were expected, only 13 and 15 of the same quality of items would be required for the understanding section and the attitude section, respectively.

In order to refine the questionnaire, the item-total correlation coefficient (R) of each item was carefully examined. For the understanding section the item-total correlation coefficient ranged from 0.456 to 0.872 and the adjusted item-total correlation coefficient ranged from 0.435 to 0.865. The average item-total correlation coefficient was 0.656 and the average adjusted item-total correlation coefficient was 0.636. For the attitude section the item-total correlation coefficient ranged from 0.385 to 0.845 and the adjusted item-total correlation coefficient ranged from 0.355 to 0.836. The average item-total correlation coefficient was 0.636 and

Table 2

Summary of the Results of Likert Attitude Scale Analysis

Resources	Understanding Section	Attitude Section
Number of Items	22	44
Number of Response Categories	2	5
Number of Respondents	36	36
Range of Possible Scores	22-44	44-220
Range of Obtained Scores	22-44	132-217
Mean of Obtained Scores	33.028	174.000
Variance	46.860	456.278
Standard Deviation	6.845	21.361
Standard Error of Measurement	1.703	4.099
Skewness (GAMMA 1)	0.001	-0.107
Kurtosis (GAMMA 2)	-1.314	-0.638
Coefficient Alpha Index of Reliability	0.938	0.963

the average adjusted item-total correlation coefficient was 0.626. Table 4 displays the distribution of item-total and adjusted item-total correlation coefficients of two sections.

According to Lemke and Wiersma (1976), items with high positive item-total correlation coefficients tend to increase test reliability. Retaining items with high item-total correlation coefficients and rejecting items with low or negative item-total correlation coefficients generally increases the reliability estimates of the test. Therefore, in order to make the questionnaire more adequate for the study, those items with low item-total correlation coefficients and similar questions were discarded from the initial questionnaire. As a result, the number of items on the final questionnaire was reduced from 22 to 18 in the understanding section and from 44 to 25 in the attitude section. The final questionnaire is presented in Appendix A.

Validity

Although reliability is a highly desired quality, it should be noted that reliability provides no assurance that test results will provide truthful information. According to Gronlund (1965), in selecting or constructing the questionnaire the most important question is: To what extent will the results serve the particular uses for which they are intended? Validity is concerned with the degree to which a test measures what it is supposed to measure.

Table 3

Estimated Number of Items Required to Achieve Certain Reliabilities

Reliabilities	0.60	0.70	0.80	0.90
Estimated Number of Items for Understanding Section	2	3	6	13
Estimated Number of Items for Attitude Section	3	4	7	15

Table 4

Distribution of Item-Total and Adjusted Item-Total Correlation Coefficients in the Pilot Study Questionnaire

Class Limits	Understanding Section		Attitude Section	
	R	Adjusted R	R	Adjusted R
Neg. - Zero	0	0	0	0
0.01 - 0.10	0	0	0	0
0.11 - 0.20	0	0	0	0
0.21 - 0.30	0	0	0	0
0.31 - 0.40	0	0	1	1
0.41 - 0.50	2	4	6	8
0.51 - 0.60	6	6	9	7
0.61 - 0.80	10	9	25	26
0.81 - 1.00	4	3	3	2

In order to find out how valid the questionnaire was, the final questionnaire was sent to a jury of experts for evaluation. Five experts in microcomputers consisting of educators and computer scientists from The Pennsylvania State University were invited to be the judges to determine the content validity of the questionnaire. They were Dr. Helmut Alt, Dr. Robert Hale, Dr. John Searles, Dr. Chester Smith, and Dr. Janos Simon. Each of the five judges was asked to evaluate and rate each item in the understanding and attitude sections by giving five points for those items they considered to be superior, four points for above-average, three points for average, two points for below-average, and one point if the item was regarded as inferior. The results indicated that the 18 understanding items received a mean rating of 4.0 with a range from 3.7 to 4.4 and the 25 attitude question items received a mean rating of 4.2 with a range from 3.5 to 5.0. Because the judges reported high scores for the items based on their critical analysis, it was decided that the questionnaire had content validity.

Collection of Data

Before the questionnaires were sent to the selected sample schools, directors in those schools were contacted by phone and asked to coordinate this study in their schools. After permission to survey in those schools was given, a complete set of questionnaire packages was mailed to the directors of those schools who indicated their

willingness to participate in the study. The questionnaire packets included the following materials:

1. A cover letter to the school director asking him/her to distribute a questionnaire to each vocational teacher.

2. An abstract briefly describing the purpose of the study.

3. The appropriate number of questionnaires with pre-addressed and stamped return mailers as well as cover letters which explained the objectives of the study and instructions for completing and returning the questionnaire.

Each director who received the questionnaire package was requested to distribute the questionnaire to each vocational teacher in his/her school. Each vocational teacher was asked to return the questionnaire directly to the researcher by mail within three weeks without any personal identification. Thereby the data were treated confidentially. Because participation in this study was voluntary, it was unreasonable to expect a 100 percent return. However, 281 questionnaires were returned to the researcher by the deadline and 273 proved usable. Thus, a 68.8 percent rate of usable returns was achieved.

Methods

Management of Data

In preparation for statistical analysis, the data were coded by the researcher. The variates in this study included age, sex,

educational level, service area, teaching experience, school location, microcomputer experience, microcomputer training, utilization of microcomputers, and the availability of microcomputers. Codings for these variates are shown in Table 5.

It was noted that not every participant answered all of the questions on the questionnaire. A response which did not provide information indicating the level to which it belonged on any specific variate was treated as missing data and excluded from the statistical test of that variate.

The criterion variables used in this study were the understandings and attitudes toward using microcomputers in vocational education. In preparation for analysis, eighteen items in the understanding section of the questionnaire were coded as 1 for "Yes" and 0 for "No." Twenty five items in the attitude section of the questionnaire were coded as 5 for "Strongly Agree," 4 for "Agree," 3 for "Uncertain or Undecided," 2 for "Disagree," and 1 for "Strongly Disagree." Several items in this section reversed the score from 1 to 5 for "Strongly Agree" to "Strongly Disagree" because those attitude items were negative. They were items 1, 3, 4, 9, 11, 12, 17, 19, 23, 24, and 25.

Analysis

The data collected from this study were analyzed using two kinds of statistics: descriptive and inferential. The descriptive

Table 5

Codings for the Variates

Variates	Levels	Coding Number
Age	20-29 years	1
	30-39 years	2
	40-49 years	3
	50-59 years	4
	Over 59 years	5
Sex	Male	1
	Female	0
Educational Level	Under 60 college credits	1
	Over 60 college credits	2
	Bachelors	3
	Some graduate work	4
	Masters	5
	Beyond masters	6
	Other	7
Service Area	Agriculture	1
	Business Occupations	2
	Distributive Education	3
	Health Occupations	4
	Home Economics	5
	Trade and Industrial	6
	Other	7
Teaching Experience	0-4 years	1
	5-9 years	2
	10-14 years	3
	15-19 years	4
	20 or more years	5

Table 5 (Continued)

Variates	Levels	Coding Number
School Location	Urban	1
	Suburban	2
	Rural	3
Microcomputer Experience	Yes	1
	No	0
Microcomputer Training	Yes	1
	No	0
Utilization of Microcomputers	Yes	1
	No	0
Availability of Microcomputers	Yes	1
	No	0

statistical analysis included the distribution of data, range, means, variance, standard deviations, percentages, frequency distributions and correlation coefficients. The procedural commands such as PROC FREQ, PROD MEANS, and PROC CORR in the Statistical Analysis System (SAS user's guide, 1982) were used to carry out this purpose. Descriptive statistical analysis provided a clear picture of the sample data. In addition, it provided answers to the questions relative to the understandings and attitudes of teachers toward using microcomputers in vocational education. The Pearson Product-Moment Correlation was used to search for relationships which existed among teachers' understandings and their attitudes toward using microcomputers and selected variates relating to teachers' characteristics.

One-factor analysis of variance (ANOVA) was the major inferential statistical technique used to test the rest of the hypotheses in this study. A one-factor analysis of variance investigated the difference in teachers' understandings about microcomputers and teachers' attitudes toward using microcomputers in vocational education between/among various groups of teachers in terms of their selected characteristics. The PROC ANOVA command in the Statistical Analysis System (SAS user's guide, 1982) was used for this analysis. When necessary, the "Follow-up After an Analysis of Variance" (FOLUP) computing program (Games, Yancey, Howell, and Serapiglia, 1981) was also employed to do follow-up for the analysis of variance.

CHAPTER IV

FINDINGS

Introduction

The purpose of this study was to determine how much knowledge vocational teachers have about microcomputers as well as to investigate the attitudes that vocational teachers hold about the use of microcomputers in vocational education. In addition, the study attempted to explore the relationships between vocational teachers' understandings of microcomputers and teachers' attitudes toward using microcomputers in vocational education and to examine some factors which may have influenced their understandings and attitudes. This chapter reports the findings under subsections which correspond to the research questions and hypotheses presented in the statement of the problem. The findings are presented sequentially as they appear in the statement of the problem. Statistical information is discussed in this chapter only to the extent of developing an understanding and interpretation of the meaning of the results. Conclusions and recommendations regarding these findings are discussed in Chapter V.

The sample used in this study was 397 vocational teachers selected from 11 area vocational-technical schools in the Commonwealth of Pennsylvania. A total of 281 vocational teachers returned the questionnaire by the deadline. Eight of them did not complete the

questionnaire. Therefore, the data analyses presented in this chapter were based on the remaining usable 273 observations.

Descriptive statistics are presented prior to the testing of the hypotheses to provide a clear picture of the sample data. Table 6 lists the frequency distributions of those selected variates in the study. Missing data were not included in the percentage calculations in this table.

Analysis of the additional background information in Part A of the questionnaire shows that 28.4 percent of vocational teachers indicated that their schools have used remote terminals, connected to computers located elsewhere, to deliver computer-assisted instruction. 52.2 percent of them indicated that their schools have not done so and the remaining 19.4 percent indicated they did not know.

As for how vocational teachers viewed their training in using microcomputers, 36 percent indicated that they received no training, 25 percent had attended a workshop or seminar, 16 percent received pre- or in-service training, 11 percent were self-taught learners, 5 percent had a college course in using microcomputers, 5 percent received individual instruction from other users, 1 percent attended a professional meeting on microcomputers, and 1 percent used other methods.

Data also indicate that only 20.6 percent of vocational teachers own a microcomputer. However, 80 percent of vocational teachers showed an interest in using microcomputers in their programs.

Table 6

Frequency Distributions of Selected Variates
(N=273)

Variate	Category	N	Percentage
Age	20-29 years	36	13.2
	30-39 years	71	26.0
	40-49 years	71	26.0
	50-59 years	72	26.4
	Over 59 years	23	8.4
Sex	Male	202	74.0
	Female	71	26.0
Educational Level	Under 60 college credits	40	14.6
	Over 60 college credits	81	29.7
	Bachelors	27	9.9
	Some graduate work	42	15.4
	Masters	46	16.9
	Beyond masters	37	13.5
Service Area	Agriculture	13	4.8
	Business Occupations	16	5.8
	Distributive Education	15	5.5
	Health Occupations	15	5.5
	Home Economics	20	7.3
	Trade and Industrial	178	65.2
	Other	16	5.9
Teaching Experience	0-4 years	45	16.5
	5-9 years	69	25.3
	10-14 years	91	33.3
	15-19 years	47	17.2
	20 or more years	21	7.7

Table 6 (Continued)

Variate	Category	N	Percentage
School Location	Urban	63	23.1
	Suburban	121	44.3
	Rural	89	32.6
Microcomputer Experience	Yes	140	51.5
	No	132	48.5
	Missing Data	1	--
Microcomputer Training	Yes	166	63.8
	No	94	36.2
	Missing Data	13	--
Utilization of Microcomputers	Yes	58	21.5
	No	212	78.5
	Missing Data	3	--
Availiability of Microcomputers	Yes	141	51.6
	No	132	48.4

* The missing data were not included in the percentage calculation.

Although all area vocational-technical schools in this study had microcomputers, only 40 percent of vocational teachers indicated that they have microcomputers available for use in their programs. Thirty-eight percent of vocational teachers indicated that they have microcomputers available for student use. In determining how vocational teachers preferred to learn to use the microcomputer, the large percentage of them indicated that they preferred one-on-one instruction by another microcomputer user (46.1%), followed by workshop (35.2%), programmed learning at the computer (30.4%), college credit courses (19.1%), and self instruction (8.7%). For interested readers, results of the percentage of responses to each of the questions in Part A of the questionnaire is presented in Appendix B.

The coefficient alpha index of reliability obtained for the understanding section in this study was 0.926, which was 0.012 lower than that obtained in the pilot study. The coefficient alpha index of reliability for the attitude section was 0.955.

Question #1

> What are the understandings and attitudes of teachers toward using microcomputers in vocational education?

The level of understanding of vocational teachers toward using microcomputers in vocational education was measured by analyzing the answers obtained from the understanding section of the questionnaire. It was revealed that the total understanding scores ranged from 0 to

18 with a maximum possible scores of 18. The mean scores and the standard deviation for the understanding section are shown in Table 7. The distribution of scores for this section of the questionnaire is shown in Table 8.

Based on analysis of the understanding section, the level of understanding which vocational teachers have about microcomputers in the Commonwealth of Pennsylvania was low. The frequency distribution for understanding scores shows that 56 percent of the vocational teachers received a score of less than the mean score of 7.46.

The level of attitude of vocational teachers toward using microcomputers in vocational education was measured based on an analysis of the data received from the attitude section of the questionnaire. It was found that the total attitude scores ranged from 52 to 125 with a maximum possible score of 125. Table 7 shows the mean score and the standard deviation for the attitude section. Table 9 shows the frequency distribution of scores on the attitude section of the questionnaire.

When the mean score is transposed to a point on the Likert scale, it shows more specifically the level of attitude that vocational teachers have about the use of microcomputers in vocational education. The mean score of 96.66 on the rating scale becomes an average of 3.89 on the 5-point Likert scale where 5 is strongly positive and 1 is strongly negative. It was revealed that 51.3 percent of the vocational teachers displayed positive attitudes toward microcomputers with a score greater than the mean score of 3.89.

Table 7

Number, Means and Standard Deviations for Vocational Teachers' Understandings and Attitudes Toward Using Microcomputers in Vocational Education

Source	N	Mean	Standard Deviation
Understanding	273	7.46	5.65
Attitude	273	96.66	15.54

Table 8

Frequency Distributions of Understanding Scores

Class Interval	Frequency	Percent	Cumulative Percent
0- 1	49	17.95	17.95
2- 4	54	19.78	37.73
5- 7	50	18.32	56.04
8-10	39	14.29	70.33
11-13	27	9.89	80.22
14-16	27	9.89	90.11
17-19	27	9.89	100.00
Totals	273	100.00	

Table 9

Frequency Distributions of Attitude Scores

Class Interval	Frequency	Percent	Cumulative Percent
49- 57	2	0.73	0.73
58- 66	8	2.93	3.66
67- 75	16	5.86	9.52
76- 84	40	14.65	24.18
85- 93	40	14.65	38.83
94-102	75	27.47	66.30
103-111	41	15.02	81.32
112-120	32	11.72	93.04
121-129	19	6.96	100.00
Totals	273	100.00	

Question #2

> What relationships exist among teachers' understandings and their attitudes toward using microcomputers in vocational education and selected variates relating to teachers' characteristics?

In order to answer this question, the following three hypotheses were examined by the Pearson Product-Moment Correlation. The data in Table 10 show the correlations among vocational teachers' understandings and their attitudes toward using microcomputers and all selected variates. The Pearson Product-Moment correlation coefficients range from -0.260 to 0.634. Those significant correlations are identified in the table.

Hypothesis 1

> There is no relationship between teachers' understandings about microcomputers and teachers' attitudes toward using microcomputers in vocational education.

The Pearson Product-Moment correlation coefficient of 0.519 showed a significant positive relationship ($p<0.01$) between teachers' understandings about microcomputers and teachers' attitudes toward using microcomputers in vocational education. Based on this finding, Hypothesis 1 was rejected. The result indicated that vocational teachers' attitudes toward using microcomputers were related to their understandings about microcomputers. This significant positive correlation revealed that the higher the level of understanding about

Table 10

Correlations Among Criterion Variables
and Selected Variates
for Question #2

Variable	Understanding	Attitude
Understanding	1.000**	0.519**
Attitude	0.519**	1.000**
Sex	-0.082	-0.096
Age	-0.154*	-0.183**
Educational level	0.228**	0.128*
Service Area	-0.260**	-0.177**
Teaching Experience	-0.020	-0.070
School Location	0.005	-0.077
Microcomputer Experience	0.634**	0.356**
Microcomputer Training	0.551**	0.306**
Utilization of Microcomputers	0.504**	0.296**
Availability of Microcomputers	0.384**	0.247**

* Significant at the 0.05 level
** Significant at the 0.01 level

microcomputers, the more positive the attitude toward using microcomputers in vocational education.

Hypothesis 2

> There is no relationship between teachers' understandings about microcomputers and selected variates relating to teachers' characteristics.

Significant positive relationships were found between vocational teachers' understandings about microcomputers and the following variates: educational level ($p<0.01$), microcomputer experience ($p<0.01$), microcomputer training ($p<0.01$), utilization of microcomputers ($p<0.01$), and availability of microcomputers ($p<0.01$). In addition, significant negative relationships were found between vocational teachers' understandings about microcomputers and their age ($p<0.05$) and service areas ($p<0.01$). Therefore, Hypothesis 2 was rejected.

Hypothesis 3

> There is no relationship between teachers' attitudes toward using microcomputers in vocational education and selected variates relating to teachers' characteristics.

It was found that age and service area had significant negative relationships ($p<0.01$) with vocational teachers' attitudes toward using microcomputers in vocational education. Other significant positive relationships were also found between vocational teachers' attitudes about the use of microcomputers in vocational education and

the following variates: educational level ($p<0.05$), microcomputer experience ($p<0.01$), microcomputer training ($p<0.01$), utilization of microcomputers ($p<0.01$), and availability of microcomputers ($p<0.01$). Based on this finding, Hypothesis 3 was rejected.

Question #3

> Are there differences in teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers between/among various groups of teachers in terms of their characteristics?

In order to answer this question, one-factor analysis of variance was used to test the following six hypothesis.

Hypothesis 4

> There is no difference in teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers by age, sex, educational level, service area, and the length of teaching experience.

The mean scores and standard deviations for five age groups of vocational teachers on their understandings and attitudes toward using microcomputers are shown in Table 11. Table 12 shows the one-factor analysis of variance summary results for the variate of age. A significant difference among the five age groups of teachers was found in their attitudes toward using microcomputers in vocational education, but not in their understandings about microcomputers. In order to find out which age group of teachers had a significant difference with which other age group(s) in their attitudes toward

Table 11

Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Age Level

Age	N	Understanding		Attitude	
		Mean	SD	Mean	SD
20-29 years	36	8.61	5.46	103.72	13.08
30-39 years	71	8.37	5.79	98.25	13.92
40-49 years	71	7.15	5.61	94.62	17.67
50-59 years	72	6.93	5.63	94.40	14.00
Over 59 years	23	5.43	5.23	94.00	18.53

Table 12

Summary of Analysis of Variance for the Variate of Age

Source	Sums of Squares	DF	F Ratio	Probability
Understanding	227.13	4	1.80	0.1285
Attitude	2800.92	4	2.98*	0.0195

* Significant at the 0.05 level

using microcomputers, the FOLUP computing program (Games, Yancey, Howell, and Serapiglia, 1981) was employed. The results of follow-up analysis are summarized in Table 13. The Behrens-F'sher t' technique with the Welch adjustment for degrees of freedom (Kirk, 1968, p. 98) was used for the calculation of t values in this table. Ten possible pairs were tested. However, only four pairs were found to be significantly different at the 0.05 level. They were: 20-29 years vs. 30-39 years, 20-29 years vs. 40-49 years, 20-29 years vs. 50-59 years, and 20-29 years vs. over 59 years. These data suggested that vocational teachers between the ages of twenty and twenty-nine hold more positive attitudes toward the use of microcomputers than any other age group of vocational teachers.

There were 202 male and 71 female participants in the study. Table 14 shows the means and standard deviations for these two groups of teachers on both criterion variables. Table 15 shows the one-factor analysis of variance summary data for the variate of sex. While female vocational teachers scores were higher than male teachers, no significant difference was found for either criterion variable.

The means and standard deviations for the six educational levels of vocational teachers on both criterion variables are shown in Table 16. Summary statistics of the one-factor analysis of variance for the variate of educational level are presented in Table 17. A significant difference among the six educational levels of teachers was found in

Table 13

Follow-Up for All Possible Pairs by Vocational Teachers' Age Level on Their Scores of Attitudes Toward Using Microcomputers

Possible Pairs	DF	Obtained t'	Critical Value
1 -- 5	36	2.191*	2.03
1 -- 4	75	3.409*	1.99
2 -- 5	30	1.012	2.04
1 -- 3	91	3.009*	1.99
2 -- 4	141	1.649	1.98
3 -- 5	36	0.141	2.03
1 -- 2	74	1.999*	1.99
2 -- 3	133	1.361	1.98
3 -- 4	133	0.081	1.98
4 -- 5	30	0.096	2.04

* Significant at the 0.05 level

Note: The numbers in each pair represent the following age groups:
1 : 20-29 years
2 : 30-39 years
3 : 40-49 years
4 : 50-59 years
5 : Over 59 years

Table 14

Number, Means, Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Sex

Sex	N	Understanding		Attitude	
		Mean	SD	Mean	SD
Male	202	7.18	5.64	95.78	15.76
Female	71	8.24	5.64	99.15	14.71

Table 15

Summary of Analysis of Variance for the Variate of Sex

Source	Sums of Squares	DF	F Ratio	Probability
Understanding	58.61	1	1.85	0.1755
Attitude	599.36	1	2.50	0.1153

Table 16

Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Educational Level

Educational Level	N	Understanding		Attitude	
		Mean	SD	Mean	SD
Under 60 college credits	40	6.63	5.15	94.80	15.41
Over 60 college credits	81	5.98	5.04	94.85	15.83
Bachelors	27	7.89	6.04	95.59	18.26
Some graduate work	42	6.79	5.17	96.36	14.53
Masters	46	9.17	5.77	100.07	14.93
Beyond Masters	37	9.92	6.37	99.49	14.66

Table 17

Summary of Analysis of Variance for the Variate of Educational Level

Source	Sums of Squares	DF	F Ratio	Probability
Understanding	589.34	5	3.90**	0.0021
Attitude	1266.80	5	1.05	0.3888

** Significant at the 0.01 level

their understandings of microcomputers, but not in their attitudes toward using microcomputers in vocational education. The follow-up analysis using the FOLUP computing program was employed in order to determine which educational level of teachers had a significant difference with which other level(s) of teachers in their understandings of microcomputers. The results of this analysis are summarized in Table 18. Six pairs were found to be significantly different at the 0.05 level: Beyond master's vs. over 60 college credits, beyond master's vs. under 60 college credits, master's vs. over 60 college credits, beyond master's vs. some graduate work, master's vs. under 60 college credits, and master's vs. some graduate work. These follow-up results showed that those vocational teachers with a master's degree or beyond had higher levels of understanding about microcomputers than those teachers with some graduate credits or those with less than a bachelor's degree.

The variate "service area" included the following seven areas: Agriculture, Business Occupations, Distributive Education, Health Occupations, Home Economics, Trade and Industrial, and Other. Table 19 lists the means and standard deviations for these service areas of teachers on both criterion variables. Business Occupations teachers demonstrated the highest level of understanding about microcomputers. The next highest scores for understanding was Distributive Education, followed by Other, Agriculture, Health Occupations, and Trade and Industrial. Home Economics teachers showed the lowest level of

Table 18

Follow-Up for All Possible Pairs by Vocational Teachers' Educational Level on Their Scores Of Understandings About Microcomputers

Possible Pairs	DF	Obtained t'	Critical Value
6 -- 2	57	3.319*	2.00
6 -- 1	69	2.482*	2.00
5 -- 2	84	3.139*	1.99
6 -- 4	69	2.378*	2.00
5 -- 1	84	2.163*	1.99
3 -- 2	39	1.483	2.02
6 -- 3	58	1.297	2.00
5 -- 4	86	2.046*	1.99
3 -- 1	50	0.890	2.01
4 -- 2	81	0.832	1.99
6 -- 5	74	0.552	1.99
5 -- 3	53	0.892	2.01
3 -- 4	49	0.782	2.01
4 -- 1	80	0.141	1.99
1 -- 2	76	0.657	1.99

* Significant at the 0.05 level

Note: The numbers in each pair represent the following educational level:

1 - Under 60 college credits
2 - Over 60 college credits
3 - Bachelor's
4 - Some graduate work
5 - Master's
6 - Beyond master's

Table 19

Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Service Area

Service Area	N	Understanding		Attitude	
		Mean	SD	Mean	SD
Agriculture	13	8.62	5.68	101.54	11.60
Business Occupations	16	14.00	5.57	105.31	9.57
Distributive Education	15	11.67	5.67	103.93	11.46
Health Occupations	15	6.93	3.13	98.67	16.91
Home Economics	20	6.25	5.06	94.90	17.65
Trade and Industrial	178	6.47	5.34	94.57	15.92
Other	16	9.06	5.59	100.69	13.20

understanding about microcomputers. Concerning teachers' attitudes toward using microcomputers in vocational education, Business Occupations teachers again showed the highest positive attitudes. The next highest attitude scores was found for Distributive Education, followed by Agriculture, Other, Health Occupations, and Home Economics. Trade and Industrial teachers showed the lowest attitudes toward the use of microcomputers in vocational education.

A substudy was done on Home Economics and Trade and Industrial teachers with less than a bachelor's degree related to their understandings and attitudes toward the use of microcomputers. The supposition that attitudes and understandings were related to the holding of less than a bachelor's degree. The data revealed that sixty-five percent of Home Economics teachers hold a bachelor's degree or beyond, whereas fifty-seven percent of Trade and Industrial teachers had less than a bachelor's degree. A large percentage of those with less than a bachelor's degree was reflected for Trade and Industrial teachers. This may be related to their measured lower level of understandings and attitudes toward the use of microcomputers.

The results of the one-factor analysis of variance test by service area are shown in Table 20. Significant differences among the seven service areas of teachers were found both in their understandings about microcomputers and in their attitudes toward using microcomputers in vocational education.

Table 20

Summary of Analysis of Variance for the Variate of Service Area

Source	Sums of Squares	DF	F Ratio	Probability
Understanding	1217.44	6	7.24**	0.0001
Attitude	3457.91	6	2.46*	0.0246

* Significant at the 0.05 level
** Significant at the 0.01 level

In order to determine which service area showed a significant difference with which other area(s) in their understandings of microcomputers and their attitudes toward using microcomputers, the Behrens-Fisher t′ technique with the Welch adjustment for degrees of freedom was employed. The results of follow-up study for all possible pairs by vocational teachers′ service areas on their scores of understandings about microcomputers was summarized in Table 21. It was indicated that eight pairs were found to be significantly different at the 0.05 level: Business Occupations vs. Home Economics, Business Occupations vs. Trade and Industrial, Distributive Education vs. Home Economics, Bus' .ess Occupations vs.

Table 21

Follow-Up Study for All Possible Pairs by Vocational Teachers' Service Areas on Their Scores of Understandings About Microcomputers

Possible Pairs	DF	Obtained t'	Critical Value
2 — 5	31	4.315*	2.04
2 — 6	18	5.196*	2.10
3 — 5	28	2.928*	2.05
2 — 4	24	4.388*	2.06
3 — 6	16	3.429*	2.12
7 — 5	31	1.563	2.04
2 — 1	26	2.561*	2.06
3 — 4	22	2.833*	2.07
7 — 6	18	1.786	2.10
1 — 5	24	1.219	2.06
2 — 7	30	2.501*	2.04
3 — 1	25	1.420	2.06
7 — 4	24	1.319	2.06
1 — 6	14	1.322	2.14
4 — 5	32	0.491	2.04
2 — 3	29	1.155	2.05
3 — 7	29	1.287	2.05
7 — 1	26	0.213	2.06
1 — 4	18	0.950	2.10
4 — 6	22	0.518	2.07
6 — 5	24	0.180	2.06

* Significant at the 0.05 level

Note: The numbers in each pair represent the following service areas:

1 - Agriculture
2 - Business Occupations
3 - Distributive Education
4 - Health Occupations
5 - Home Economics
6 - Trade and Industrial
7 - Other

Health Occupations, Distributive Education vs. Trade and Industrial, Business Occupations vs. Agriculture, Distributive Eduation vs. Health Occupations, and Business Occupations vs. Other. These data showed that Business Occupations teachers were more knowledgeable about using microcomputers than those teachers in Home Economics, Trade and Industrial, Health Occupations, Agriculture and Other. In addition, Distributive Education teachers had higher levels of understanding about microcomputers than those teachers in Home Economics, Trade and Industrial, and Health Occupations. These results may be related to the fact that Business Occupations teachers and Distributive Education teachers have greater exposure to computers and microcomputers in their occupational areas.

Table 22 presents a summary for all possible pairs by vocational teachers' service areas on their scores of attitudes toward using microcomputers. It was found that only three pairs were found to be significantly different at the 0.05 level: Business Occupations vs. Trade and Industrial, Business Occupations vs. Home Economics, and Distributive Education vs. Trade and Industrial. These results showed that Business Occupations teachers were more favorable toward the use of microcomputers in vocational education than those teachers in Trade and Industrial, and Home Economics. Also, Distributive Education teachers were more supportive of using microcomputers than Trade and Industrial teachers.

The means and standard deviations for the five groups of teachers in terms of their teaching experience on both criterion variables are

Table 22

Follow-Up Study for All Possible Pairs by Vocational Teachers' Service Areas on Their Scores of Attitudes Toward Using Microcomputers

Possible Pairs	DF	Obtained t'	Critical Value
2 -- 6	23	4.018*	2.07
2 -- 5	30	2.256*	2.04
3 -- 6	19	2.934*	2.09
2 -- 4	22	1.335	2.07
3 -- 5	32	1.831	2.04
1 -- 6	16	2.030	2.12
2 -- 7	27	1.135	2.05
3 -- 4	25	0.998	2.06
1 -- 5	31	1.303	2.04
7 -- 6	19	1.743	2.09
2 -- 1	23	0.941	2.07
3 -- 7	29	0.732	2.05
1 -- 4	25	0.529	2.06
7 -- 5	34	1.125	2.03
4 -- 6	16	0.904	2.12
2 -- 3	27	0.363	2.05
3 -- 1	25	0.548	2.06
1 -- 7	27	0.184	2.05
7 -- 4	26	0.369	2.06
4 -- 5	31	0.640	2.04
5 -- 6	23	0.079	2.07

* Significant at the 0.05 level

Note: The numbers in each pair represent the following service areas:

1 - Agriculture
2 - Business Occupations
3 - Distributive Education
4 - Health Occupations
5 - Home Economics
6 - Trade and Industrial
7 - Other

shown in Table 23. Table 24 gives the summary statistics of one-factor analysis of variance for the variate of the length of teaching experience. No significant difference was found in either criterion variable among five groups of teachers when considering the length of their teaching.

In summary, it was found that there were significant differences in teachers' understandings about microcomputers among various groups of teachers in terms of their eduational level and service area. In addition, there were significant differences in teachers' attitudes toward using microcomputers among various groups of teachers in terms of their age and service area. Therefore, Hypothesis 4 was rejected.

Hypothesis 5

> There is no difference in teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers by the location of school.

Among the three school locations, the mean scores and standard deviations for teachers' understandings and their attitudes toward using microcomputers are shown in Table 25. Table 26 shows one-factor analysis of variance summary data for the variate of school location. The results of the analysis indicated that there was not a significant difference in either teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers among the three school locations. Therefore, Hypothesis 5 was retained.

Table 23

Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by the Length of Teaching Experience

Teaching Experience	N	Understanding		Attitude	
		Mean	SD	Mean	SD
0- 4 years	45	8.16	5.24	100.16	14.79
5- 9 years	69	7.75	5.31	97.67	15.49
10-14 years	91	6.67	5.88	94.29	16.01
15-19 years	47	7.28	5.83	95.26	14.55
20 or more years	21	8.81	6.10	99.24	16.68

Table 24

Summary of Analysis of Variance for the Variate of Teaching Experience

Source	Sums of Squares	DF	F Ratio	Probability
Understanding	124.29	4	0.97	0.4128
Attitude	1365.07	4	1.42	0.2268

Table 25

Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by School Location

School Location	N	Understanding		Attitude	
		Mean	SD	Mean	SD
Urban	63	7.19	5.84	98.44	13.21
Suburban	121	7.69	5.75	96.79	15.94
Rural	89	7.34	5.41	95.21	16.50

Table 26

Summary of Analysis of Variance for the Variate of School Location

Source	Sums of Squares	DF	F Ratio	Probability
Understanding	12.10	2	0.19	0.8282
Attitude	388.72	2	0.80	0.4487

Hypothesis 6

> There is no difference between teachers who had experience in working with microcomputers and those who have not in their understandings about microcomputers or their attitudes toward using microcomputers.

Table 27 shows the means and standard deviations for these two groups of teachers on both criterion variables. Summary statistics for one-factor analysis of variance for Hypothesis 6 are shown in Table 28. Significant differences between teachers who had experience in working with microcomputers and those who have not had such experience were found both in their understandings about microcomputers and in their attitudes toward using microcomputers in vocational education. Accordingly Hypothesis 6 was rejected. Further analysis showed that teachers who had experience in working with microcomputers were more knowledgeable of and more in favor of using microcomputers in vocational education than those who had not had such experience.

Hypothesis 7

> There is no difference between teachers who have had special training, workshops, pre- or in-service training, and college courses in using microcomputers and those who have not in their understandings about microcomputers or their attitudes toward using microcomputers.

The mean and standard deviations for these two groups of teachers on both criterion variables are shown in Table 29. Table 30 presents the summary statistics for the one-factor analysis of variance for

Table 27

Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Microcomputer Experience

Microcomputer Experience	N	Understanding		Attitude	
		Mean	SD	Mean	SD
Yes	140	10.93	5.19	102.00	15.13
No	132	3.77	3.32	90.95	13.96

Table 28

Summary of Analysis of Variance for the Variate of Microcomputer Experience

Source	Sums of Squares	DF	F Ratio	Probability
Understanding	3486.37	1	181.76**	0.0001
Attitude	8311.07	1	39.13**	0.0001

** Significant at the 0.01 level

Table 29

Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Microcomputer Training

Microcomputer Training	N	Understanding		Attitude	
		Mean	SD	Mean	SD
Yes	166	10.01	5.39	100.66	15.26
No	94	3.54	3.24	90.78	14.07

Table 30

Summary of Analysis of Variance for the Variate of Microcomputer Training

Source	Sums of Squares	DF	F Ratio	Probability
Understanding	2507.23	1	111.22**	0.0001
Attitude	5865.55	1	26.62**	0.0001

** Significant at the 0.01 level

Hypothesis 7. Significant differences between teachers who have had training in using microcomputers and those who have not had such training were found both in their understandings about microcomputers and in their attitudes toward using microcomputers in vocational education. Hypothesis 7 was accordingly rejected. Subsequent analysis showed that teachers who have had training in using microcomputers were more knowledgeable of and more positive toward using microcomputers in vocational education. These results supported that training in using microcomputers can help vocational teachers better understand and support the use of microcomputers in vocational education.

Hypothesis 8

> There is no difference between teachers who have used microcomputers in vocational education programs and those who have not in their understandings about microcomputers or their attitudes toward using microcomputers.

Table 31 provides the means and standard deviations for these two groups of teachers on both criterion variables. One-factor analysis of variance results for Hypothesis 8 are shown in Table 32. The results indicated that there were significant differences between teachers who have used microcomputers in vocational education programs and those who have not in their understandings about microcomputers and in their attitudes toward using microcomputers. Therefore, Hypothesis 8 was rejected. Further analysis showed that teachers who have used microcomputers in vocational education programs were more

Table 31

Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Utilization of Microcomputers

Utilization of Microcomputers	N	Understanding		Attitude	
		Mean	SD	Mean	SD
Yes	58	12.91	4.65	105.47	15.19
No	212	6.00	4.94	94.29	14.75

Table 32

Summary of Analysis of Variance for the Variate of Utilization of Microcomputers

Source	Sums of Squares	DF	F Ratio	Probability
Understanding	2173.90	1	91.21**	0.0001
Attitude	5685.19	1	25.78**	0.0001

** Significant at the 0.01 level

knowledgeable of and more in favor of the use of microcomputers in vocational education than those who have not used microcomputers.

Hypothesis 9

> There is no difference in teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers by the availability of microcomputers at home or at school.

The means and standard deviations for these two groups of teachers on both criterion variables are shown in Table 33. Presented in Table 34 are summary statistics for the one-factor analysis of variance for Hypothesis 9. Significant differences between teachers who have had microcomputers available for their use either at home or at school and those who have not had microcomputers available for their use were found both in their understandings about microcomputers and in their attitudes toward using microcomputers in vocational education. Therefore, Hypothesis 9 was rejected. Further analysis indicated that teachers who have had microcomputers available for their use either at home or at school showed a higher level of understanding about microcomputers and more support for the use of microcomputers in vocational education.

Summary

The findings of the study are summarized as follow:

1. Vocational teachers in the Commonwealth of Pennsylvania had a low level of knowledge about microcomputers, but they

Table 33

Number, Means, and Standard Deviations for Teachers' Understandings and Attitudes Toward Using Microcomputers by Availability of Microcomputers

Availability of Microcomputers	N	Understanding		Attitude	
		Mean	SD	Mean	SD
Yes	141	9.55	5.52	100.37	15.86
No	132	5.22	4.88	92.69	14.21

Table 34

Summary of Analysis of Variance for the Variate of Availability of Microcomputers

Source	Sums of Squares	DF	F Ratio	Probability
Understanding	1280.29	1	46.97**	0.0001
Attitude	4020.55	1	17.67**	0.0001

** Significant at the 0.01 level

appeared to have a positive attitude toward using microcomputers in vocational education.

2. Most vocational teachers showed an interest in using microcomputers in their programs. They preferred to learn to use the microcomputer by one-on-one instruction from another microcomputer user, workshops, or programmed learning.
3. Vocational teachers' attitudes toward the use of microcomputers in vocational education were related to their understandings about microcomputers. The better the vocational teachers understand microcomputers, the more the vocational teachers are in favor of using microcomputers in vocational education.
4. Some vocational teachers' characteristics were significantly related to vocational teachers' understandings about microcomputers and their attitudes toward using microcomputers in vocational education. These characteristics were age, educational level, service area, microcomputer experience, microcomputer training, utilization of microcomputers, and the availability of microcomputers.
5. Vocational teachers' attitudes toward using microcomputers differed by their age. The younger the age, the more the positive attitude toward the use of microcomputers in vocational education.
6. Vocational teachers' understandings about microcomputers differed by their educational level. Those vocational

teachers with a master's degree or beyond had higher levels of understanding about microcomputers than those teachers with some graduate credits or those with less than a bachelor's degree.

7. Vocational teachers' understandings about microcomputers and their attitudes toward using microcomputers differed by their service area.
8. Vocational teachers who had experience in working with microcomputers were more knowledgeable of and more in favor of using microcomputers in vocational education than those who have not had such experience.
9. Vocational teachers who have had training in using microcomputers were more knowledgeable of and more positive toward using microcomputers in vocational education than those who have not had such training.
10. Vocational teachers who have used micrccomputers in their programs were more knowledgeable of and more in favor of the use of microcomputers in vocational education than those who have not used microcomputers.
11. Very few vocational teachers owned a microcomputer. However, all selected sample area vocational-technical schools in this study had microcomputers. Vocational teachers who have had microcomputers available for their use either at home or at school showed a higher level of understanding about

microcomputers and more support for the use of microcomputers in vocational education.

12. Sex, length of teaching experience, and location of school were not found to have a significant effect on vocational teachers' understandings about microcomputers and their attitudes toward using microcomputers in vocational education.

13. Since much of the sample was composed of Trade and Industrial teachers, an additional analysis was done for that group. The Pearson Product-Moment Correlation Analysis suggested that there was a significant positive correlation between Trade and Industrial teachers' understandings about microcomputers and their attitudes toward using microcomputers. It was found that Trade and Industrial teachers' understandings about microcomputers were correlated with age, microcomputer experience, microcomputer training, utilization of microcomputers, and the availability of microcomputers. In addition, Trade and Industrial teachers' attitudes toward using microcomputers were correlated with microcomputer experience, microcomputer training, utilization of microcomputers, and the availability of microcomputers. The tabular data for this analysis is presented in Appendix C.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A summary of the study as well as conclusions and recommendations are presented in this chapter.

Summary

Statement of the Problem

During the past few years, the use of microcomputers in academic settings has expanded dramatically. Educators around the world are keenly aware of the impact of the microcomputer and are rapidly infusing computer education into curriculums. Vocational educators have recently expressed great interest in microcomputer application for their programs. However, the attitudes of vocational teachers toward microcomputers and their uses in vocational education will greatly influence their commitment to and the subsequent success of vocational education programs. The purpose of this study was to determine how much knowledge vocational teachers have about microcomputers and to investigate the attitudes that vocational teachers have about the use of microcomputers in vocational education. In addition, the study attempted to explore the relationships between vocational teachers' understandings of microcomputers and teachers' attitudes toward using microcomputers in vocational education and to

examine some factors which may have influenced their understandings and attitudes. In order to achieve this purpose, the study sought to answer the following questions:

Question #1: What are the understandings and attitudes of teachers toward using microcomputers in vocational education?

Question #2: What relationships exist among teachers' understandings and their attitudes toward using microcomputers in vocational education and selected variates relating to teachers' characteristics?

Question #3: Are there differences in teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers between/among various groups of teachers in terms of their characteristics?

Procedures

All vocational teachers in area vocational-technical schools in the Commonwealth of Pennsylvania during school year 1983-1984 were considered as the target population. The final sample for this study consisted of 273 vocational teachers from eleven randomly selected area vocational-technical schools in the Eastern, Central, and Western regions of Pennsylvania.

The questionnaire used in this study included three major parts. The first part was designed to survey selected vocational teachers' characteristics such as age, sex, educational level, service area, teaching experience, school location, microcomputer experience, microcomputer training, utilization of microcomputers, and the availability of microcomputers. The second part of the questionnaire

consisted of 18 questions and was designed to measure vocational teachers' understandings about microcomputers in vocational education. The last part was a 25-item Likert attitude scale which was designed to measure vocational teachers' attitudes toward using microcomputers in vocational education.

A pilot study was conducted to evaluate and validate the questionnaire before it was applied. A total of 36 persons of whom 21 were graduate students who were majoring in either agricultural education, home economics education, or vocational-industrial education at The Pennsylvania State University, as well as 15 vocational teachers who taught in Centre County AVTS and Seneca Highlands AVTS participated in the pilot study. The results of the pilot study indicated that the coefficient alpha index of reliability was 0.938 and 0.963 for the understanding and the attitude sections respectively. In addition, the results suggested that the number of items required to achieve the desired reliability of each section of the questionnaire. As a result, the number of items on the final questionnaire was reduced from the orginal 22 items to 18 items in the understanding section and from the orginal 44 items to 25 items in the attitude section.

Before the questionnaire was used, it was evaluated and approved by the Behavioral and Social Science Review Committee on Human Subjects at The Pennsylvania State University. Questionnaires were then mailed to school directors who had indicated their willingness to

participate in the study in a previous phone contact. Each director who received the questionnaire package was requested to distribute the questionnaire to each vocational teacher in his/her school. The final usable observations numbered 273, for a 68.8 percent rate of usable returns.

Descriptive and inferential statistics were employed in the study. Descriptive statistical analysis provided a clear picture of the sample data. Provided also were answers to questions relative to the understandings and attitudes of teachers toward using microcomputers in vocational education. The Pearson Product-Moment Correlation was used to search for relationships which existed among teachers' understandings and attitudes toward using microcomputers and selected variates relating to teachers' characteristics. One-factor analysis of variance was the major inferential statistic used to investigate the difference in teachers' understandings about microcomputers and teachers' attitudes toward using microcomputers in vocational education between/among various groups of teachers in relation to selected characteristics.

Findings

(1) Question #1: What are the understandings and attitudes of teachers toward using microcomputers in vocational education?

This question was answered by computing the means and standard deviations of both understanding and attitude scores. It was found

that the level of understanding vocational teachers have about microcomputers in the Commonwealth of Pennsylvania was low. Fifty-six percent of the vocational teachers received an understanding score of less than the mean score of 7.46. However, 51.3 percent of the vocational teachers showed positive attitudes with a score greater than the mean score of 96.66. Vocational teachers overall favor the use of microcomputers in vocational education.

(2) Question #2: What relationships exist among teachers' understandings and their attitudes toward using microcomputers in vocational education and selected variates relating to teachers' characteristics?

Pearson Product-Moment Correlation Analysis showed that there was significant positive correlation between teachers' understandings about microcomputers and teachers' attitudes toward using micrcomputers in vocational education. It was also found that teachers' understandings about microcomputers and their attitudes toward using microcomputers were positively correlated with educational level, microcomputer experience, microcomputer training, utilization of microcomputers, and the availability of microcomputers. Teachers' understandings about microcomputers and their attitudes toward the use of microcomputers showed negative relationships with age and service area.

The following is the list of rejection or retention of all hypotheses related to Question #2:

H.1: There is no relationship between teachers' understandings about microcomputers and teachers' attitudes toward using microcomputers in vocational education. (The Hypothesis was rejected.)

H.2: There is no relationship between teachers' understandings about microcomputers and selected variates (age, sex, educational level, service area, teaching experience, school location, microcomputer experience, microcomputer training, utilization of microcomputers, and availability of microcomputers) relating to teachers' characteristics. (The Hypothesis was rejected.)

H.3: There is no relationship between teachers' attitudes toward using microcomputers in vocational education and selected variates relating to teachers' characteristics. (The Hypothesis was rejected.)

(3) Question #3: Are there differences in teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers between/among various groups of teachers in terms of their characteristics?

The results of one-factor analysis of variance showed that there were significant differences in teachers' understandings about microcomputers between/among various groups of teachers in terms of their educational level, service area, microcomputer experience, microcomputer training, utilization of micrcomputers, and the availability of microcomputers. In addition, it was found that there were significant differences in teachers' attitudes toward using uicrocomputers between/among various groups of teachers in terms of their age, service area, microcomputer experience, microcomputer training, utilization of microcomputers, and the availability of microcomputers.

The rejection or retention of all hypotheses in relation to Question #3 are listed as follow:

H.4: There is no difference in teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers by age, sex, educational level, service area, and the length of teaching experience. (The hypothesis was rejected.)

H.5: There is no difference in teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers by the location of school. (The hypothesis was retained.)

H.6: There is no difference between teachers who have had experience in working with microcomputers and those who have not in their understandings about microcomputers or their attitudes toward using microcomputers. (The hypothesis was rejected.)

H.7: There is no difference between teachers who have had special training, workshops, pre- or in-service training, and college courses in using microcomputers and those who have not in their understandings about microcomputers or their attitudes toward using microcomputers. (The hypothesis was rejected.)

H.8: There is no difference between teachers who have used microcomputers in vocational education programs and those who have not in their understandings about microcomputers or their attitudes toward using microcomputers. (The hypothesis was rejected.)

H.9: There is no difference in teachers' understandings about microcomputers or teachers' attitudes toward using microcomputers by the availability of microcomputers at home or at school. (The hypothesis was rejected.)

Conclusions

The following conclusions were drawn from the findings of this study:

1. It is concluded that training activities on the use of microcomputers in vocational education are needed.
2. It is concluded that vocational teachers are interested in and support the use of microcomputers in vocational education.
3. It is concluded that the better the vocational teachers understand microcomputers the more they are supportive in

implementing the use of microcomputers in vocational education.

4. It is concluded that vocational teachers in different disciplinary areas in vocational education display different levels of understandings and show different feelings about the use of microcomputers in vocational education.
5. It is concluded that vocational teachers with higher educational levels have greater exposure to the use of microcomputers.
6. It is concluded that because younger vocational teachers hold more favorable attitudes toward microcomputers more in-service efforts need be directed toward more senior teachers.
7. It is concluded that training in using microcomputers can help vocational teachers better understand and implement the use of microcomputers in vocational education.
8. It is concluded that the instrument used in this study has high applicability for measurements in this study area. This instrument might be considered for use in further research studies in this area.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are made:

1. Since vocational teachers' understandings about microcomputers were low, more workshops or in-service training programs should be developed to increase vocational teachers' familiarity with and knowledge about microcomputers.
2. Programs required for vocational teachers' certification should include at least a course in computer literacy for vocational teachers to learn how to operate microcomputers and investigate the ways microcomputers could be applied to their field.
3. Since availability of microcomputers was found to have an effect on vocational teachers' understandings and their attitudes toward using microcomputers, more microcomputers should be made available for use by vocational teachers and students in the schools.
4. Development of high quality and creative courseware for vocational education programs should be encouraged.
5. Each area vocational-technical school should have an instructional software library which provides software for vocational teachers' use in their fields.
6. Since most vocational teachers preferred to learn to use the microcomputer by one-on-one instruction from another microcomputer user, it is recommended that microcomputer user groups should be organized in the school so that vocational

teachers can exchange their knowledge and experience as well as help beginning microcomputer users understand the potential instructional uses of microcomputers.

7. Since vocational teachers in Trade and Industrial and Home Economics areas displayed the lowest level of understanding about microcomputers, special attention should be given to helping these teachers develop computer literacy and become more knowledgeable about the instructional uses of microcomputers.
8. Vocational educators and administrators should begin to plan for the implementation of microcomputers in vocational education programs as soon as possible since most vocational teachers appeared to be highly interested and support the use of microcomputers in vocational education.
9. State Department of Education, vocational education centers, and vocational education institutions should support information dissemination and provide expertise and resources to assist area vocational-technical schools to implement and successfully use microcomputers in vocational education programs.

References

Ahl, D. H. Survey of public attitudes toward computers in society. In D. H. Ahl (Ed.), The best of creative computing (Vol 1). Morristown, New Jersey: Creative Computing Press, 1976, 77-79.

Aiken, R. M., & Braun, L. Into the 80's with microcomputer-based learning. Computer, 1980, 13(7), 11-16.

Asplen, D. Mini-computers and the building trades: A guide for teachers of vocational education. Final Report. West Chester, Pennsylvania: West Chester State College, 1980. (ERIC Document Reproduction Service Number ED 201 754)

Bass, C. C., Brown, D., & Nold, E. Computers and teacher education. Educational Technology, 1975, 15(9), 55-57.

Beck, J. J. An analysis of student attitude toward computer-assisted instruction in Nebraska public high schools. Unpublished doctoral dissertation, University of Nebraska, 1979.

Becker, H. J. Microcomputers in the classroom - Dream and realities. Baltimore, Maryland: The Johns Hopkins University, 1982.

Bell, T. E. Computer Literacy: The fourth "R". Personal Computing, 1983, 7(5), 63-69. (a)

Bell, T. E. My computer, my teacher. Personal Computing, 1983, 7(6), 120-127. (b)

Bork, A., & Franklin, S. Personal computers in learning. Educational Technology, 1979, 19(10), 7-12.

Bouyer, C. J. Knowledge, attitudes and priorities of Iowa home economics educators for educational applications of microcomputers. Unpulished masters thesis, Iowa State University, 1982.

Brumbaugh, K. Computer literacy - 1985. The Computing Teacher, December 1980, 49.

Burns, P. K., & Bozeman, W. C. Computer-assisted instruction and mathematics achievement: Is there a relationship? Educational Technology, 1981, 21(10), 32-39.

Cavin, C. S., Cavin, E. D., & Lagowski, Y. Y. The effect of computer assisted instruction on the attitudes of college students toward computers and chemistry. Journal of Research in Science Teaching, 1981, 18(4), 329-333.

Chambers, J., & Bork, A. Computer assisted learning in U. S. secondary/elementary schools. New York: Association for Computing Machinery, 1980. (ERIC Document Reproduction Service Number ED 202 461)

Chambers, J., & Sprecher, J. Computer assisted instruction: Current trends and critical issues. Communications of the Association for Computing Machinery, 1980, 23(6), 232-243.

Cheng, W. L. Using computers in graphic arts. School Shop, 1982, 41(8), 27.

Coburn, P., Kelman, P., Roberts, N., Synder, T., Watt, D., & Weiner, C. A practical guide to computers in education. Reading, Massachusetts: Addison-Wesley, 1982.

Crowder, N. A. Automatic tutoring by intrinsic programming. In A. A. Lumsdaine & R. Glaser (Eds.), Teaching machines and programmed learning. Washington, D. C.: National Education Association, 1960.

Danford, J. Is your career development program tailored for the real world. Technological Horizons in Education Journal, 1974, 1(5), 35-38.

Dupuis, V. L., & Bell, P. E. A modular approach to vocational curriculum. Blueprint for individualized instruction. American Vocational Journal, 1974, 49(4), 34-36.

Eisele, J. E. Classroom use of microcomputers. Educational Technology, 1979, 19(10), 13-15.

Eisele, J. E. A case for universal computer literacy. Journal of Research and Development in Education, 1980, 14(1), 84-89.

Elliott, P., & Peele, H. Computer-augmented teacher training. In S. D. Milner (Ed.), Topics in instructional computing (Vol. 1). New York: Association for Computing Machinery, 1975.

Emmett, A. American education: The dead end of the 80s. Personal Computing, 1983, 7(8), 96-105.

Federal Register, 42(191), October, 1977.

Floyd, M. A. An investigation of public school teachers' knowledge about, attitude toward, and willingness to use microcomputers as instructional tools. Unpublished doctoral dissertation, The Pennsylvania State University, 1983.

Forman, D. Search of the literature. In D. O. Harper & J. H. Stewart (Eds.), Run: Computer education. Monterey, California: Brooks/Cole Publishing Company, 1983.

Games, P. A., Yancey, J. M., Howell, J. F., & Serapiglia, T. Follow-up after an analysis of variance. University Park, Pennsylvannia: The Pennsylvania State University, The Computation Center, 1981.

Gronlund, N. E. Measurement and evaluation in teaching. Toronto, Ontario: The Macmillan Company, 1965.

Hallworth, H. J. & Brebner, A. Computer assisted instruction in schools: Achievements, present, developments, and projections for the future. Alberta, Canada: University of Calgary, 1980. (ERIC Document Reproduction Service Number ED 200 187)

Henderson, D. L. Educational uses of the computer: Implications for teacher/administrator training. Educational Technology, 1978, 18(8), 41-42.

Holmes, G. Computer-assisted instruction: A discussion of some of the issues for would-be implementors. Educational Technology, 1982, 22(9), 7-13.

Hunter, B. What makes a computer-literate college? Conference on Computers in the Undergraduate Curricula, University of Denver, 1978.

Jelden, D. L. The microcomputer as an interactive instruction system in the classroom. Greeley, Colorado: University of Northern Colorado, 1980. (ERIC Reproduction Service Number ED 194 710)

Kearsley, G., Hillesohn, M. J., & Seidel, R. J. The use of microcomputers for training: Business and industry. Alexandria, Virginia: Human Resource Research Organization, March 1981. (ERIC Document Reproduction Service Number ED 207 598)

Kerlinger, F. The first and second-order factor structures of attitudes toward education. American Education Research Journal, 1967, 4, 191-205.

Kirk, R. E. Experimental design: Procedures for the behavioral sciences. California: Brooks/Cole, 1968.

Kohr, R. L. Likert attitude scale analysis. University Park, Pennsylvania: The Pennsylvania State University, The Computation Center, June 1974.

Kulik, J. A., Bangert, R. L., & Williams G. W. Effects of computer-based teaching on secondary school students. Journal of Educational Psychology, 1983, 75(1), 19-26.

Lemke, E. & Wiersma, W. Principles of psychological measurement. Chicago, Illinois: Rand-McNally College Publishing Company, 1976.

Lichtman, D. Survey of educator's attitudes toward computers. Creative Computing 1979, 5(1), 48-50.

Lidtke, D. K. Securing teacher acceptance of technology. Paper presented at the National Conference on Technology and Education. Washington, D. C., 1981, 26-28.

Love, J. Computers in schools. Educational Times, 1982, 3(34), 8.

Magison, E. M. Trends in computer-assisted education. Educational Technology, 1978, 18(4), 5-8.

Matthews, J. I. Microcomputer application in industrial education. Man/Society/Technology, 1980, 39(6), 25-27.

McIsaac, D. N. The implementation of micro CMI. Association for the Development of Computer-Based Instructional System (ADCIS) Proceedings, 1980.

Melmed, A. S. Information Technology for U. S. schools. Phi Delta Kappan, 1982, 63(5), 308-311.

Milner, S. D. How to make the right decisions about microcomputers. Instructional Innovator, 1980, 25(6), 12-19. (a)

Milner, S. D. Teaching teachers about computers: A necessity for education. Phi Delta Kappan, 1980, 61(8), 544-546. (b)

Molnar, A. R. Understanding how to use machines to work smarter in an information society. Technological Horizons in Education, 1980, 7(1), 42-46.

Nasman, L. O. Computers mean new decisions. VOCED, 1982, 57(3), 36-38.

National Education Association. A teacher survey NEA report: Computers in the classroom. Washington, D. C.: National Education Association, 1983. (ERIC Document Reproduction Service Number ED 229 343)

Office of Technology Assessment. Informational technology and its impact on American education. Washington, D. C.: U. S. Government Printing Office, November 1982.

Osborne, A. Running wild the next industrial revolution. Berkley, McGraw Hill, 1979.

Passmore, D. L. Influence of recent developments in computer technology on professional development in vocational education, Final report. Harrisburg, Pennsylvania: Pennsylvania Department of Education, Bureau of Vocational Education, Vocational Program Support Service Section, 1983.

Pennsylvania Department of Education. Microcomputer survey prediminary report. Harrisburg, Pennsylvania: Pennsylvania Department of Education, 1983.

Pickard, N. J. Attitudes of South Dakota home economics teachers toward the use of microcomputers. Unpublished masters thesis, South Dakota State University, 1983.

Podemski, R. Computer technology and teacher education. Journal of Teacher Education. 1981, 32, 29-33.

Poirot, J. & Heidt, M. Planning for educational computing: A questionnaire for educators. Electronic Learning, 1982, 2(1), 34-38.

Randolph, J., & Bringman, D. Computers are another tool for your shop. Industrial Arts and Vocational Education, 1971, 60(4), 24-25, 27.

Rannells, B. Concept of the 70's - Individualized student instruction. Agricultural Education, 1973, 46(1), 9-10.

Rice, D. R. & Mosow, D. K. The microcomputer in the schools of the 80's: Dawn of a new age? Educational Computer, 1981, 1(4), 44-46.

Robardely, C. P. A study of selected Michigan elementary and secondary teachers' and principals' attitudes toward computer assisted instruction (Doctoral dissertation, Michigan State University, 1971). Dissertation Abstracts International, 1972, 32, 4929-A. (University Microfilms No. 72-8770, 185)

Roblyer, M. D. Investing in the future: Computers in Florida education. Florida Vocational Journal, 1980, 5(9), 18-21.

SAS Institute, Inc. SAS user's guide. (1979 ed.) Cary, North Carolina: SAS, 1979.

Schneider, M. S. Computer assisted skills assessment in the secondary math curriculum. Technological Horizons in Education Journal, 1980, 7(3), 34-35.

Seaman, J. Microcomputers invade the executive suite. Computer Decisions, February 1981.

Skinner, B. F. The science of learning and the art of teaching. Harvard Education Review, 1954, 24, 86-97.

Spencer, D. D. Computers in society: The wheres, whys, and hows of computer use. Rochelle Park, New Jersey: Hayden Book Company, Inc, 1974.

Spitzer, D. R. Toward response-based educational technology. Educational Technology, 1980, 20(5), 33-35.

Splittgerber, F. L. Computer-based instruction: A revolution in the making. Educational Technology, 1979, 19(1), 20-26.

Stevens, D. J. How educators perceive computers in the classroom. AEDS Journal, 1980, 13, 221-232.

Stewart, J. Computer shock: The inhuman office of the futrue. Saturday Review, July 23, 1979.

Taylor, J. A., & Parrish, J. W. A national survey on the uses of, and attitudes toward programed instruction and computers in public school and college music education. Journal of Computer-Based Instruction, 1978, 5(1-2), 11-21.

Uthe, E. F. The computers in our lives. VOCED, 1982, 57(3), 26-29.

VonFeldt, J. R. An overview of computers in education. Rochester, New York: National Technical Institue for the Deaf, 1977. (ERIC Document Reproduction Service Number ED 160 043)

Watt, D. H. Computer literacy: What should schools be doing about it? Classroom Computers News, 1980, 1(2), 26-27.

Westberg, C. W. Bedding down with a computer. Florida Vocational Journal, 1980, 6(4), 27-28.

Wilkins, R., Leising, J. Inservice workshops on new and emerging agriculture/natural resources occupation instruction materials. Final report. Davis, California: University of California, Davis, Department of Applied Behavioral Sciences, 1981. (ERIC Reproduction Service Number ED 205 743)

APPENDIX A

QUESTIONNAIRE

THE PENNSYLVANIA STATE UNIVERSITY
COLLEGE OF EDUCATION
Division of Occupational and Vocational Studies
RACKLEY BUILDING
UNIVERSITY PARK, PENNSYLVANIA 16802

January 13, 1984

Dear Vocational Teacher:

I am conducting a study concerning vocational teachers' opinions about the use of microcomputers in vocational education. The purpose of this study is to secure information to provide direction for curriculum development, instructional methods and strategies, supervision and management, and teacher training in vocational education. Your school has been selected as one of the sample schools for this study, and you are invited to participate in this research activity.

In order to complete this study, I request your assistance to answer the following questionnaire. Your response to this questionnaire is extremely important not only to the success of this study but also to vocational education. Please take a few minutes to complete the questions on the following pages, and mail it back to me by refolding and stapling the questionnaire.

Your cooperation is needed and will be appreciated. The return of the completed questionnaire by February 10, 1984 will greatly assist me.

Thank you very much for your time and assistance.

Sincerely,

John Brandt

John Brandt, Supervisor
Trade and Industrial Education
Pennsylvania Department of Education

Chi-Yin Yuen

Chi-Yin Yuen, Graduate Assistant
Division of Occupational
and Vocational Studies

MICROCOMPUTERS IN VOCATIONAL EDUCATION SURVEY

This is a study of the understandings and the attitudes that vocational teachers have about the use of microcomputers in vocational education. It is intended that this information will be used to provide a clearer direction for vocational administrators and educators who plan for the implementation of microcomputers in vocational education.

This questionnaire consists of three parts. Instructions for completing each section are provided at the beginning of the section. Please follow directions carefully and answer each part of the questionnaire completely. ***Please note that this is NOT a test and that all answers will be kept confidential.*** Your cooperation in completing this questionnaire is greatly appreciated.

PART A: Background Information

These are general descriptive questions that will help the investigator to classify the responses. They are for developing general categories and are NOT for the purpose of identification.

*INSTRUCTIONS: **Please fill in or check appropriate blanks.***

1. Please indicate your sex.
   ___ a. Male ___ b. Female

2. Please indicate your age category.
   ___ a. 20-29 years
   ___ b. 30-39 years
   ___ c. 40-49 years
   ___ d. 50-59 years
   ___ e. over 59 years

3. In which of the vocational areas do you teach?
   ___ a. Agriculture
   ___ b. Business Occupations
   ___ c. Distributive Education
   ___ d. Health Occupations
   ___ e. Home Economics
   ___ f. Trade and Industrial
   ___ g. Other, please specify _____

4. Please indicate your number of years of teaching experience.
   ___ a. 0-4 years
   ___ b. 5-9 years
   ___ c. 10-14 years
   ___ d. 15-19 years
   ___ e. 20 or more years

5. Please indicate your highest level of education attained.
   ___ a. Under 60 college credits
   ___ b. Over 60 college credits
   ___ c. Bachelors
   ___ d. Some graduate work
   ___ e. Masters
   ___ f. Beyond masters
   ___ g. Others, please specify _____

6. In what type of area is your school located?
___ a. Urban ___ b. Suburban ___ c. Rural

7. To your knowledge, has your school ever used remote terminals, connected to computers located elsewhere, to deliver computer-assisted instruction?
___ a. Yes ___ b. No ___ c. Don't know

8. Have you had any experience working with microcomputers?
___ a. Yes ___ b. No
If 'yes,' please indicate the number of months of experience _____

9. Which **one** of these statements is most comparable to the training you have received for using microcomputers?
___ a. have received no training
___ b. have attended workshop(s) or seminar(s)
___ c. have received pre- or in-service training
___ d. have had a college course in using microcomputers
___ e. have attended a professional meeting on microcomputers
___ f. am mainly a self-taught learner
___ g. have received individual instruction from another microcomputer user
___ h. other, please specify _____

10. Do you own a microcomputer?
___ a. Yes ___ b. No
If 'yes,' please specify the model of microcomputer _____

11. Does your school own any microcomputers?
___ a. Yes ___ b No
If 'yes,' please specify the model(s) of microcomputer _____
the number of microcomputers _____

12. Are microcomputers available for your use in your program?
___ a. Yes ___ b. No

13. Are microcomputers available for your students to use in your program?
___ a. Yes ___ b. No

14. Have you used a microcomputer in your instructional program?
___ a. Yes ___ b. No

15. If you are not now using microcomputers, would you be interested in using them in your program?
___ a. Yes ___ b. No

16. If you are not familiar with microcomputers, how would you prefer to learn to use the microcomputer? Please check one or more.
___ a. Self-taught
___ b. One-on-one instruction by another microcomputer user
___ c. Programmed learning right at the computer
___ d. Workshop on microcomputers
___ e. College credit courses in microcomputers
___ f. Other, please specify _____

PART B: Your Understanding about Microcomputers

The following questions have been selected to measure your level of understanding about microcomputers in vocational education. Please respond to the following questions in a manner that best agrees with your understanding of microcomputers.

INSTRUCTIONS: Please circle the appropriate response.

1. Do you read about microcomputers?	Yes	No
2. Do you consider yourself to be "computer literate"?	Yes	No
3. Can you operate a microcomputer well enough to use a commerically produced computer program?	Yes	No
4. Do you know BASIC or any other computer language?	Yes	No
5. Have you written a computer program?	Yes	No
6. Can you develop an algorithm for solving a problem?	Yes	No
7. Can you read, understand, and modify existing computer programs?	Yes	No
8. Do you know how microcomputers are used?	Yes	No
9. Do you know how microcomputers do their work?	Yes	No
10. Do you know how microcomputers affect our society?	Yes	No
11. Do you understand the basic components of a microcomputer?	Yes	No
12. Do you have experience in using microcomputers for either text preparation, test scoring, or packaged instructional programs?	Yes	No
13. Do you consider yourself informed about the use of microcomputers in your field?	Yes	No
14. Do you know of any commerically produced computer programs available for your field?	Yes	No
15. Can you evaluate and select an appropriate commerically produced computer program for your field?	Yes	No
16. Can you integrate computerized teaching materials into a course?	Yes	No
17. Do you know sources of computer materials?	Yes	No
18. Can you assist in the selection and acquisition of microcomputers?	Yes	No

PART C: Your Opinions about Microcomputers in Vocational Education

Listed below is a series of statements about the use of microcomputers in vocational education. You are asked to agree or disagree with each statement on an ordinal scale. There are NO RIGHT OR WRONG answers — only your personal opinions.

INSTRUCTIONS: Please indicate your personal opinion about each statement by circling one of the five possible choices.

Strongly Agree ..... **SA**
Agree ..... **A**
Uncertain or Undecided ..... **U**
Disagree ..... **D**
Strongly Disagree ..... **SD**

1. Microcomputers are too expensive to use as instructional tools.	SA	A	U	D	SD
2. The use of microcomputers can improve the quality of vocational education in schools.	SA	A	U	D	SD
3. I do not enjoy using a microcomputer.	SA	A	U	D	SD
4. Using microcomputers in schools will isolate students from other students.	SA	A	U	D	SD
5. Schools should purchase microcomputers for instructional use.	SA	A	U	D	SD
6. A microcomputer will help students learn.	SA	A	U	D	SD
7. Vocational teachers should be computer literate.	SA	A	U	D	SD
8. Implementation of microcomputers for instruction should be encouraged.	SA	A	U	D	SD
9. Microcomputers used for instruction will cause more problems than they will solve.	SA	A	U	D	SD
10. The microcomputer is a useful instructional tool.	SA	A	U	D	SD
11. Microcomputers are too complicated for me to use in my classroom.	SA	A	U	D	SD
12. The use of microcomputers requires a strong background in mathematics.	SA	A	U	D	SD
13. Using microcomputers would add interest to my programs.	SA	A	U	D	SD

14. The use of a microcomputer in my program would improve my instructional effectiveness.	SA	A	U	D	SD
15. I look forward to the time when microcomputers are used in vocational education programs.	SA	A	U	D	SD
16. I am confident about the potential for using microcomputers in my program.	SA	A	U	D	SD
17. Using microcomputers for instruction would make learning too mechanical.	SA	A	U	D	SD
18. Microcomputers are a flexible medium for instruction.	SA	A	U	D	SD
19. Having a microcomputer readily available in my program poses a threat to job security.	SA	A	U	D	SD
20. Students should understand the impact of microcomputers on society.	SA	A	U	D	SD
21. Microcomputer instruction and use should occur in most subject areas.	SA	A	U	D	SD
22. The microcomputer can be used as a tutor to simulate complex concepts.	SA	A	U	D	SD
23. Microcomputers are of little value in vocational education.	SA	A	U	D	SD
24. Microcomputers in schools have an adverse effect on students.	SA	A	U	D	SD
25. My subject area is not appropriate for using the microcomputer.	SA	A	U	D	SD

APPENDI B

SUMMARY OF RESPONSES TO EACH QUESTION IN
PART A OF THE QUESTIONNAIRE

1. Please indicate your sex.

   a. Male (74.0%) b. Female (26.0%)

2. Please indicate your age category.

   a. 20-29 years (13.2%)
   b. 30-39 years (26.0%)
   c. 40-49 years (26.0%)
   d. 50-59 years (26.4%)
   e. over 59 years (8.4%)

3. In which of the vocational areas do you teach?

   a. Agriculture (4.8%)
   b. Business Occupations (5.9%)
   c. Distributive Education (5.5%)
   d. Health Occupations (5.5%)
   e. Home Economics (5.5%)
   f. Trade and Industrial (65.2%)
   g. Other (5.8%)

4. Please indicate your number of years of teaching experience.

   a. 0-4 years (16.5%)
   b. 5-9 years (25.3%)
   c. 10-14 years (33.3%)
   d. 15-19 years (17.2%)
   e. 20 or more years (7.7%)

5. Please indicate your highest level of education attained.

   a. Under 60 college credits (14.7%)
   b. Over 60 college credits (29.7%)
   c. Bachelors (9.9%)
   d. Some graduate work (15.4%)
   e. Masters (16.8%)
   f. Beyond masters (13.5%)

6. In what type of area is your school located?

   a. Urban (23.1%) b. Suburban (44.3%) c. Rural (32.6%)

7. To your knowledge, has your school ever used remote terminals, connected to computers located elsewhere, to deliver computer-assisted instruction?

   a. Yes (28.4%) b. No (52.2%) c. Don't know (19.4%)

8. Have you had any experience working with microcomputers?

   a. Yes (51.5%) b. No (48.5%)

9. Which one of these statements is most comparable to the training you have received for using microcomputers?

   a. have received no training (36.2%)
   b. have attended workshop(s) or seminar(s) (24.6%)
   c. have received pre- or in-service training (16.2%)
   d. have had a college course in using microcomputers (4.6%)
   e. have attended a professional meeting on microcomputers (1.5%)
   f. am mainly a self-taught learner (10.8%)
   g. have received individual instruction (4.6%)
   h. other (1.5%)

10. Do you own a microcomputer?

    a. Yes (20.6%) b. No (79.4%)

11. Does your school own any microcomputers?

    a. Yes (100.0%) b. No (0.0%)

12. Are microcomputers available for your use in your program?

    a. Yes (40.2%) b. No (59.8%)

13. Are microcomputers available for your students to use in your programs?

    a. Yes (37.5%) b. No (62.5%)

14. Have you used a microcomputer in your instructional program?

    a. Yes (21.5%) b. No (78.5%)

15. If you are not now using microcomputers, would you be interested in using them in your program?

    a. Yes (80.0%) b. No (20.0%)

16. If your are not familiar with microcomputers, how would you prefer to learn to use the microcomputer? Please check one or more.

    a. Self-taught (8.7%)
    b. One-on-one instruction by another microcomputer user (46.1%)
    c. Programmed learning right at the computer (30.4%)
    d. Workshop on microcomputers (35.2%)
    e. College credit courses in microcomputers (19.1%)

APPENDIX C

CORRELATIONAL DATA FOR TRADE AND INDUSTRIAL TEACHERS

Variable	Understanding	Attitude
Understanding	1.000**	0.516**
Attitude	0.516**	1.000**
Sex	0.017	-0.003
Age	-0.157*	-0.124
Educational level	0.085	0.020
Teaching Experience	-0.071	-0.065
School Location	0.089	-0.113
Microcomputer Experience	0.640**	0.292**
Microcomputer Training	0.548**	0.219**
Utilization of Microcomputers	0.562**	0.297**
Availability of Microcomputers	0.518**	0.238**

* Significant at the 0.05 level
** Significant at the 0.01 level